

NASA CR-156848

Data Report for December 1976  
through March 1978

on

A DEPOLARIZATION AND ATTENUATION EXPERIMENT  
USING THE COMSTAR AND CTS SATELLITES

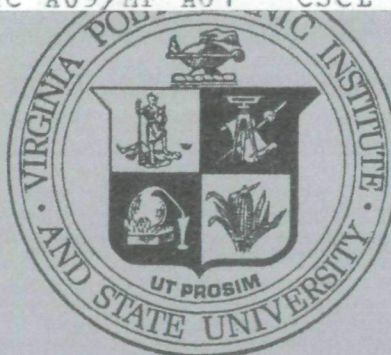
159901  
(NASA-CR-159901 A DEPOLARIZATION AND  
ATTENUATION EXPERIMENT USING THE COMSTAR AND  
CTS SATELLITES Data Report, Dec. 1976 -  
Mar. 1978 (Virginia Polytechnic Inst. and  
State Univ.) 198 p HC A09/MF A01 CSCL 20N G3/32 35786

N78-33287

N78-33287

Unclas

35786



Virginia Polytechnic Institute  
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Electrical Engineering

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A DEPOLARIZATION AND ATTENUATION EXPERIMENT  
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Contract NAS5-22577

April 28, 1978

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                           |                                                                             |           |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|-----------------------------------------------------------------------------|-----------|
| 1. Report No.                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 2. Government Accession No.               | 3. Recipient's Catalog No.                                                  |           |
| 4. Title and Subtitle<br>A Depolarization and Attenuation Experiment<br>Using the COMSTAR and CTS Satellites                                                                                                                                                                                                                                                                                                                                                   |                                           | 5. Report Date                                                              |           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                           | 6. Performing Organization Code                                             |           |
| 7. Author(s)<br>C.W. Bostjan, E.A. Manus, R.E. Marshall,<br>W.P. Overstreet, R.R. Persinger, J.D. Powell,<br>P. Santiago, W.L. Stutzman, P.H. Wiley                                                                                                                                                                                                                                                                                                            |                                           | 8. Performing Organization Report No.<br>1978-2                             |           |
| 9. Performing Organization Name and Address<br>Department of Electrical Engineering<br>340 Whittemore Hall<br>VPI&SU, Blacksburg, Virginia 24061                                                                                                                                                                                                                                                                                                               |                                           | 10. Work Unit No.                                                           |           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                           | 11. Contract or Grant No.<br>NAS5-22577                                     |           |
| 12. Sponsoring Agency Name and Address<br>NASA Goddard Space Flight Center<br>Greenbelt, Md. 20771<br>E. Hirschmann, Code 953, Technical Officer                                                                                                                                                                                                                                                                                                               |                                           | 13. Type of Report and Period Covered<br>Data Report:<br>Dec. 76 - March 78 |           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                           | 14. Sponsoring Agency Code                                                  |           |
| 15. Supplementary Notes                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                           |                                                                             |           |
| 16. Abstract<br><br>This report presents monthly statistical data on ground rainfall rate and attenuation on satellite downlinks at 11.7 GHz, 19.04 GHz, and 28.56 GHz and on cross-polarization isolation at 11.7 GHz. Regression equations for relating isolation to attenuation, attenuation to rain rate, and attenuation at one frequency to attenuation at another frequency are also included. Longer-term statistics are also presented and discussed. |                                           |                                                                             |           |
| 17. Key Words (Selected by Author(s))<br>polarization, depolarization,<br>attenuation, millimeter wave<br>propagation, communications satellites,<br>CTS, COMSTAR, percent-of-time,<br>frequency scaling, monthly statistics                                                                                                                                                                                                                                   |                                           | 18. Distribution Statement<br><br>Unlimited                                 |           |
| 19. Security Classif. (of this report)<br>U                                                                                                                                                                                                                                                                                                                                                                                                                    | 20. Security Classif. (of this page)<br>U | 21. No. of Pages                                                            | 22. Price |

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## 1. INTRODUCTION

### 1.1 Description of the Report

This report summarizes the precipitation attenuation and depolarization data collected by VPI&SU from December 1, 1976, through March 31, 1978, on satellite downlinks operating at 11.7, 19.04, and 28.56 GHz. This was the data collection portion of the period for which the experiment received funds from the Defense Communications Agency (DCA), and the report is submitted to fulfill our contractual requirement of a final data report for DCA.

### 1.2 Guide to Related Literature

In this report the data are presented without extensive comment. For a theoretical discussion of the phenomena involved, a comparison of theory with experiment, and a computer model for predicting attenuation and depolarization, the reader should consult

R. R. Persinger, "Millimeter Wave Propagation Modeling of Inhomogeneous Rain Media for Satellite Communications Systems, Report 1978-1, NASA Contract NAS5-22577, VPI&SU, Blacksburg, Virginia, May 1, 1978.

A detailed description of the hardware aspects of the experiment is given by

C. W. Bostian et al, "Quarterly Technical Progress Report I on A Depolarization and Attenuation Experiment Using the COMSTAR and CTS Satellites," NASA Contract NAS5-22577, VPI&SU, Blacksburg, Virginia, December 22, 1976.

For an explanation of the statistical data reduction techniques used to prepare this report the reader should see

C. W. Bostian et al, "Final Report (Second Year of Work) on a Depolarization and Attenuation Experiment Using the COMSTAR and CTS Satellites," NASA Contract NAS5-22577, VPI&SU, Blacksburg, Virginia, February 9, 1978.

### 1.3 Discussion of the Report Contents

DCA funding was formally transferred by NASA to VPI&SU at the end of September, 1976, to pay for the construction of COMSTAR-19.04 and 28.56 GHz terminals. At that time the University was already operating an 11.7 GHz attenuation and depolarization experiment for NASA using CTS.

When DCA funds were received CTS was turned off for the eclipse period, and when spacecraft operations resumed the VPI&SU receiver was found to be damaged by a water leak in the parametric amplifier housing. Operations were resumed on a temporary basis in November, 1976; December, 1976, was the first full month of data collection following eclipse and it is therefore the first month for which data

are presented in this report. With NASA's permission we ceased operations during February, 1977, to make permanent repairs to the CTS equipment, and hence no data appear for that month.

The COMSTAR D-2 28 GHz downlink became operational in April, 1977, and data appear here for that system beginning with the month of May, 1977. Attenuation data for the D-2 19 GHz system became available in May, 1977, and data collected at this frequency appear in the report beginning with June, 1977. For the period in which we have CTS data but not COMSTAR data this report provides estimates of what the COMSTAR attenuation statistics would have been. These were derived by multiplying the 11.7 GHz attenuation in dB by 1.48 to approximate the 19.04 GHz attenuation and by 2.71 to approximate the 28 GHz attenuation. The 1.48 and 2.71 attenuation ratios were obtained from measured attenuation data taken during the summer of 1977.

Chapter 2 of this report is devoted to monthly results and Chapter 3 considers data from longer periods of time. For each time period reported the following tables appear.

Table 1. Key Parameters summarizes the rain and signal behavior for the month. It gives the total rain accumulation, the peak rain rate, and the percent of the total rain accumulation that fell at 10, 20, 30, 40, and 50 mm/hr. Also presented are the monthly mean signal levels at IF; these will give the reader an idea of the overall stability of the satellite beacon transmitters and the receiver gains from one month to the next. Where available we have also presented

agree closely with theoretical predictions. Power curves, on the other hand, can give similar results for widely differing coefficients. For this reason our a and b coefficients in the table frequently depart from theory while the attenuation : rainrate relationship that they describe agrees well with theory.

Also included in each monthly group are percentage-of-time plots of the attenuation and rain rate data contained in the table.

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## 2. MONTHLY DATA

This chapter summarizes the data collected on a month-by-month basis. Below is a brief commentary on each month which appears; in it appear the total hours of rainfall\* during the month and the percentage of these hours during which attenuation and isolation data were collected. In reading these figures the reader should keep in mind several factors.

(1) Unless otherwise noted, attenuation measurements were made during all periods of heavy rain when the receivers could maintain phase lock. Small departures from 100% for attenuation measurement times generally represent intentional interruptions during light rain for equipment checks, etc. (2) Cross-polarized signal components are almost always at least 10 dB below the corresponding co-polarized signal components, and this means that during severe fades the cross-polarized components will be corrupted by noise first. Thus isolation data will normally be available for a slightly smaller percentage of time than is attenuation data taken over the same time period. (3) For statistical purposes missed attenuation data can be filled in by frequency scaling.

December, 1976. (Section 2.1) Rain fell for 18 hours, but the rain rate was insignificant and no rain rate plots are given. CTS attenuation and isolation data were collected for 100 and 99.9% of the time. Attenuation values for 19 and 28 GHz were scaled.

January, 1977. (Section 2.2) During this month the rain rate was negligible and no rain rate plots appear. Very light rain fell for

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\* Rainfall is arbitrarily defined as existing when the rain rate exceeds 0.5 mm/hr.

a total of 9 hours, and CTS isolation and attenuation data were collected for 98% of this time. Attenuation values for 19 and 28 GHz were scaled.

February, 1977. (Section 2.3) No data were collected; the VPI&SU earth station was closed down for repairs.

March, 1977. (Section 2.4) Rain fell for 14 hours. CTS attenuation and isolation data were collected for 75.4 and 75.2% of time time, respectively. Attenuation values for 19 and 28 GHz were scaled.

April, 1977. (Section 2.5) There were 27 hours of rain in April. Attenuation measurements were made for 87.0% of this time and isolation data for 86.5%.

May, 1977. (Section 2.6) This was the first full month of 28 GHz data collection. Rain fell for a total of 9 hours, and attenuation data were collected for 93.6% of time time at 11.7 GHz and 87.1% of this time at 28 GHz. The corresponding firugres for isolation were 92.6% and 77.4%; problems were encountered with 28 GHz depolarization data because of an antenna problem which affected the cross-polarized channel.

June, 1977. (Section 2.7) We recorded 23 hours of rainfall and collected 11.7 GHz attenuation and isolation data for 99.3% and 98.4% of time time. At 28 GHz attenuation and isolation data were taken for 95.1% and 30.4% of the rain time. Continuing antenna problems were responsible for the low isolation percentage. The 19 GHz system became operational during June and collected attenuation data for 88.9% of the rain time.

July, 1977. (Section 2.8) This was the first full month of 19 GHz operational and during 4 hours of rain 19 GHz attenuation and isolation data were collected 89.3% and 78.4% of the time. The corresponding

figures for the 11.7 GHz system were 91.7% and 89%. At 28 GHz attenuation data were collected during 87% of the rain time. Isolation data at this frequency were invalidated by the continuing antenna defect which was located and repaired near the end of the month.

August, 1977. (Section 2.9) Rain fell for six hours and attenuation data were recorded for 96.2% of this time at 19 GHz and 73.2% of this time at 28 GHz. For isolation the corresponding figures were 77.2% and 63.3% respectively. The 11.7 antenna positioner malfunctioned and limited attenuation and isolation data collection to 38.2% and 38.0% of the rain time; missing attenuation data were filled in by scaling.

September, 1977. (Section 2.10) September brought 17 hours of rain. Attenuation data were collected for 94.2% of this time at 11 GHz, for 100% of this time at 19 GHz, and for 97.9% of this time at 28 GHz; the isolation figures were 93.9% (11.7 GHz), 97.9% (28 GHz), 12.3% (19 GHz vertical), and 99.2% (19 GHz horizontal). During this period the CTS spacecraft was shut down every day for eclipse; this biased the isolation data but its effects were removed from the attenuation records.

October, 1977. (Section 2.11) It rained for 15 hours and attenuation data were collected for 94.0% (11.7 GHz), 100% (19 GHz), and 94.5% (28 GHz) of this time. The isolation values were 90.9% (11.7 GHz), 95.8% (19 GHz), and 93.8% (28 GHz).

November, 1977. (Section 2.12) A total of 25 hours of rain were recorded. The experiment collected attenuation data for 73.4% (11.7 GHz), 85.6% (28 GHz), and 85.3% (19 GHz) of this time. The percentages for isolation were 70.8% (11.7 GHz), 85.5% (28 GHz), and 83.8% (19 GHz). Occasional local oscillator malfunction may have biased the 19 GHz data, however.

December, 1977. (Section 2.13) December was a period during which repeated CTS spacecraft maneuvers were conducted. We were not provided timely tracking information and were able to collect 11.7 GHz attenuation and isolation for 65.3% and 65% of the 14 hours of rainfall. At 28 GHz the attenuation percentage was 100% and the value for isolation was 99.1%. The 19 GHz system was disabled by a local oscillator failure and operated only during 38.2% of the rain time for attenuation and 36.5% for isolation.

January, 1978. (Section 2.14) This month and the two months following were marked by heavy falls of snow, sleet, and freezing rain. Data collected during known periods of antenna contamination were deleted from the data base. Under weather conditions like those experienced, tipping bucket rain gauges tend to freeze, fill up with ice and snow, and then send out false indications of rainfall when rising temperatures melt the gauge contents. For this reason, the rain data quoted for January, February, and March, 1978, must be treated with caution. During January, the gauges reported 53 hours of rainfall for which we collected valid attenuation data 78.6% (11.7 GHz), 56.9 (19 GHz) and 56.8% (28 GHz) of the time. The corresponding isolation percentages are 78.1% (11.7 GHz), 48.7% (19 GHz) and 55.8% (28 GHz). It should be emphasized that during these winter months we noted occasional instances of severe attenuation and depolarization from sleet and snow while the antennas were clear and no precipitation was being observed on the ground.

February, 1978. (Section 2.15) Our gauges indicated rain for 5 hours, but they were probably measuring melting snow. Attenuation data for 11.7 GHz may have been influenced by periodic shutdowns of the spacecraft.

March, 1978. (Section 2.16) Snow and rain were mixed during this month, and snow filling the antennas was a recurrent problem. Our gauges recorded 33 hours of rainfall, some of which was melting snow. Attenuation data were collected for 62.3% (11.7 GHz), 20.9% (19 GHz), and 52.7% (28 GHz) of the time that the gauges indicated rain. Corresponding figures for isolation were 61.9% (11.7 GHz), 18.9% (19 GHz), and 52.7% (28 GHz).

2.1 December, 1976

Rainfall was insignificant and no rain rate plots are given. 19 and 28 GHz attenuation are scaled. There was insufficient data from which to develop regression equation.

Table 2.1-1.

Key parameters for the month of December, 1976.

1. Rain Data

VPI&SU Accumulation, 39.83 mm

USWS Accumulation, 72.90 mm

Peak VPI&SU Rate, 12.53 mm/hr

Percent of monthly accumulation at

R > 10 mm/hr, 2.29%

R > 20 mm/hr, 0%

R > 50 mm/hr, 0%

R > 30 mm/hr, 0%

R > 40 mm/hr, 0%

2. Signal Data

| Channel | Monthly Mean<br>Co Signal, dBm | Maximum Fade,<br>dB | Minimum Isolation<br>While in Phaselock, dB |
|---------|--------------------------------|---------------------|---------------------------------------------|
| 11.7    | -82.25                         | 9.65                | 20.88                                       |
| 19.04V  | -----                          | ----                | -----                                       |
| 19.04H  | -----                          | ----                | -----                                       |
| 28.56   | -----                          | ----                | -----                                       |

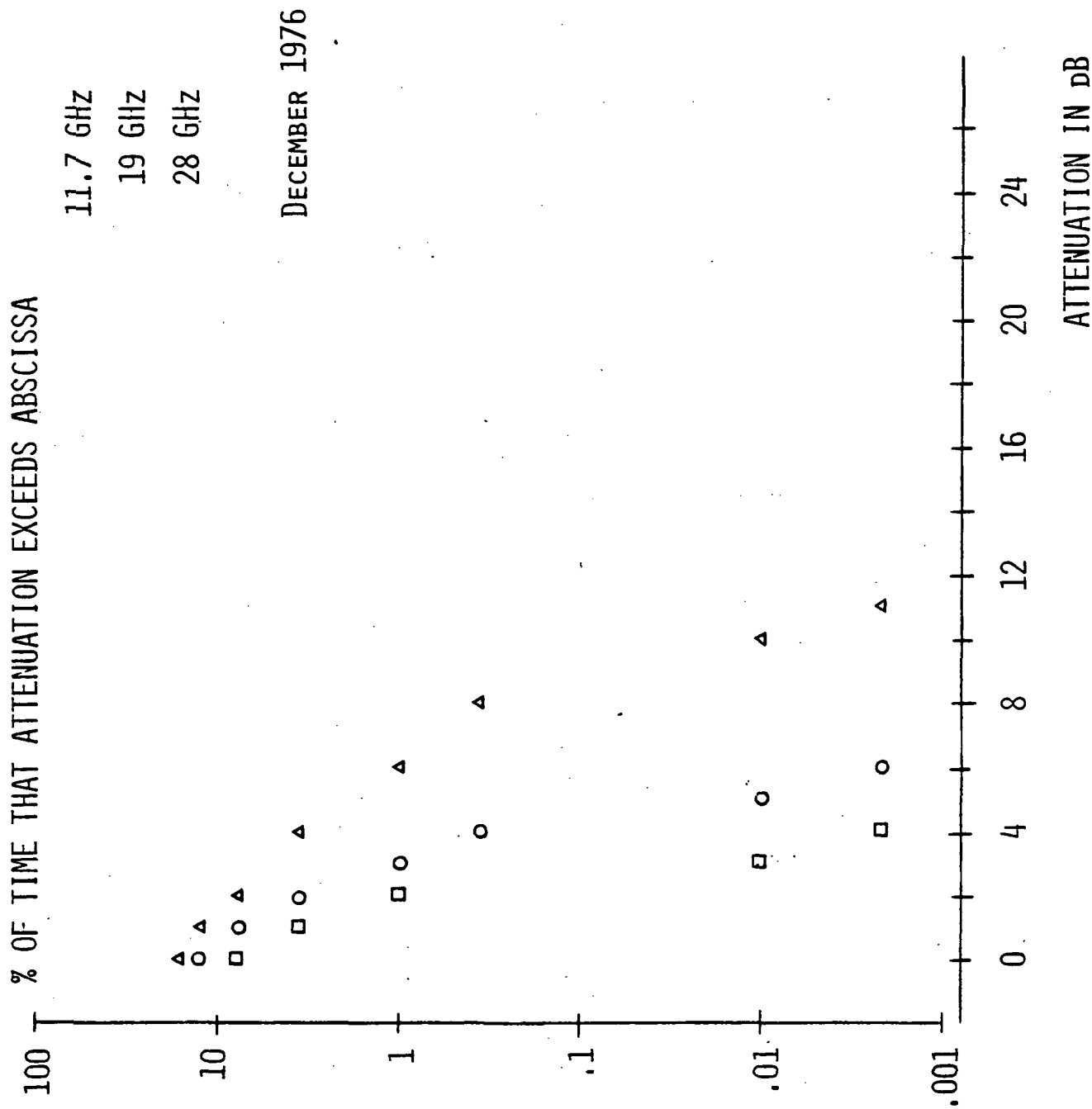


Figure 2.1-1. Attenuation statistics for December, 1976.



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| RAIN | ACTS | AV19 | AC28 | PER    |
|------|------|------|------|--------|
| .    | .    | 0    | 0    | 16.405 |
| .    | .    | 1    | 1    | 14.527 |
| .    | 0    | .    | .    | 7.259  |
| .    | .    | 1    | 2    | 7.198  |
| .    | 1    | 2    | 4    | 3.693  |
| 0    | .    | .    | .    | 2.274  |
| 1    | 2    | 3    | 6    | 1.190  |
| 2    | .    | .    | .    | 0.903  |
| 3    | .    | .    | .    | 0.672  |
| .    | .    | 4    | 8    | 0.485  |
| 4    | .    | .    | .    | 0.395  |
| 5    | .    | .    | .    | 0.231  |
| 6    | .    | .    | .    | 0.108  |
| 7    | .    | .    | .    | 0.057  |
| 8    | .    | .    | .    | 0.027  |
| 9    | .    | .    | .    | 0.021  |
| .    | 3    | 5    | 10   | 0.015  |
| 10   | .    | .    | .    | 0.011  |
| 11   | .    | .    | .    | 0.006  |
| .    | 4    | 6    | 11   | 0.003  |
| 12   | 9    | 14   | 26   | 0.002  |
|      |      |      |      | 0.000  |

Table 2.1-2. Attenuation and rain rate  
percent-of-time data for  
December, 1976.

2.2 January, 1977

Rainfall was insignificant and no rain rate plots are given. 19 and 28 GHz attenuation are scaled. The low attenuation recorded did not justify regression equation.

Table 2.2-1.

Key parameters for the month of January, 1977.

1. Rain Data

VPI&SU Accumulation, 10.66 mm

USWS Accumulation, 50.55 mm

Peak VPI&SU Rate, 4.69 mm/hr

Percent of monthly accumulation at

R > 10 mm/hr, 0%      R > 20 mm/hr, 0%      R > 50 mm/hr, 0%

R > 30 mm/hr, 0%      R > 40 mm/hr, 0%

2. Signal Data

| Channel | Monthly Mean<br>Co Signal, dBm | Maximum Fade,<br>dB | Minimum Isolation<br>While in Phaselock, dB |
|---------|--------------------------------|---------------------|---------------------------------------------|
| 11.7    | -82.90                         | 3.39                | 28.9                                        |
| 19.04V  | -----                          | -----               | -----                                       |
| 19.04H  | -----                          | -----               | -----                                       |
| 28.56   | -----                          | -----               | -----                                       |

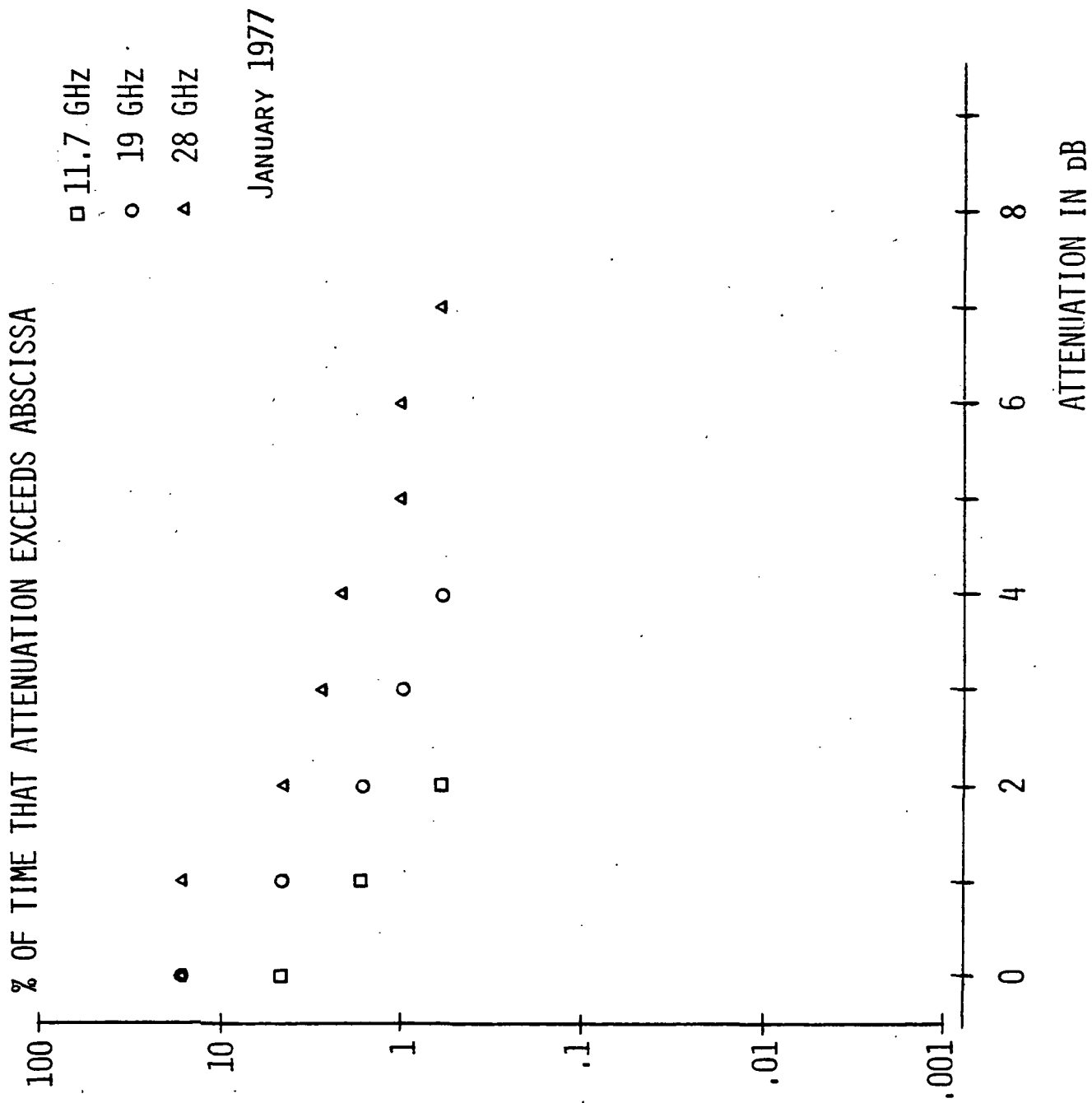


Figure 2.2-1. Attenuation statistics for January, 1977.

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| RAIN | ACTS | AV19 | AC28 | PER    |
|------|------|------|------|--------|
| .    | .    | .    | 0    | 15.731 |
| .    | .    | 0    | 1    | 14.701 |
| .    | 0    | .    | 2    | 4.733  |
| .    | .    | 1    | .    | 4.327  |
| .    | .    | .    | 3    | 3.089  |
| .    | .    | .    | 4    | 2.169  |
| .    | 1    | 2    | .    | 1.500  |
| .    | .    | .    | 5    | 1.061  |
| .    | .    | 3    | 6    | 1.033  |
| 0    | .    | .    | .    | 0.591  |
| .    | 2    | 4    | 7    | 0.560  |
| 1    | .    | .    | .    | 0.100  |
| 2    | .    | .    | .    | 0.022  |
| 3    | .    | .    | .    | 0.009  |
| 4    | 3    | 5    | 9    | 0.000  |

Table 2.2-2. Attenuation and rain rate  
percent-of-time data for  
January, 1977.

2.3 February, 1977

No data were collected; our station was shut down for repairs.

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Table 2.4-1.

Key parameters for the month of March, 1977.

1. Rain Data

VPI&SU Accumulation, 57.00 mm

USWS Accumulation, 53.59 mm

Peak VPI&SU Rate, 60.93 mm/hr

Percent of monthly accumulation at

R > 10 mm/hr, 31.42%    R > 20 mm/hr, 19.00%    R > 50 mm/hr, 2.38%

R > 30 mm/hr, 11.21%    R > 40 mm/hr, 7.16%

2. Signal Data

| Channel | Monthly Mean<br>Co Signal, dBm | Maximum Fade,<br>dB | Minimum Isolation<br>While in Phaselock, dB |
|---------|--------------------------------|---------------------|---------------------------------------------|
| 11.7    | -80.14                         | 10.89               | 21.28                                       |
| 19.04V  | -----                          | ----                | -----                                       |
| 19.04H  | -----                          | ----                | -----                                       |
| 28.56   | -----                          | ----                | -----                                       |

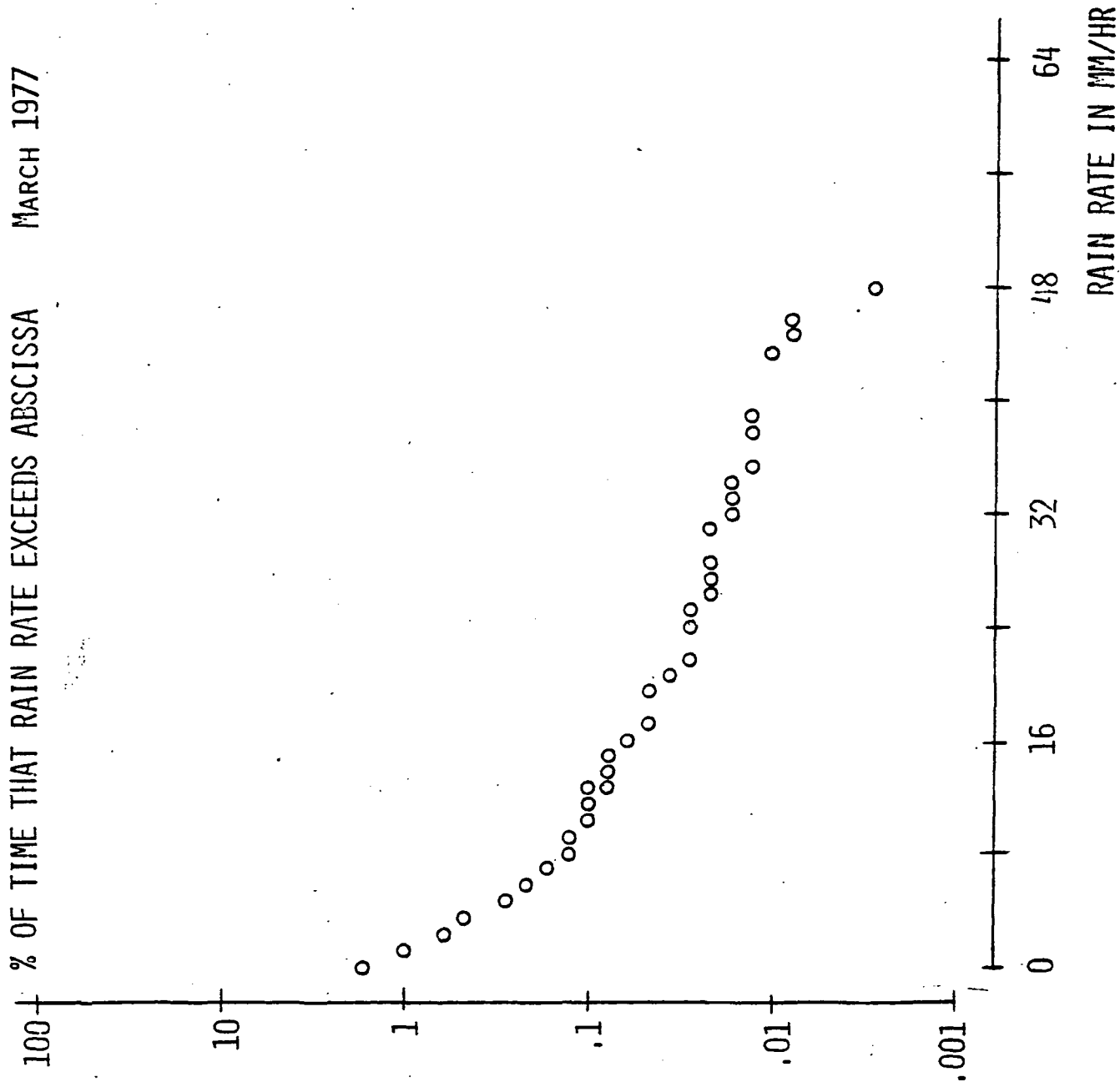


Figure 2.4-1. Rain rate statistics for March, 1977.



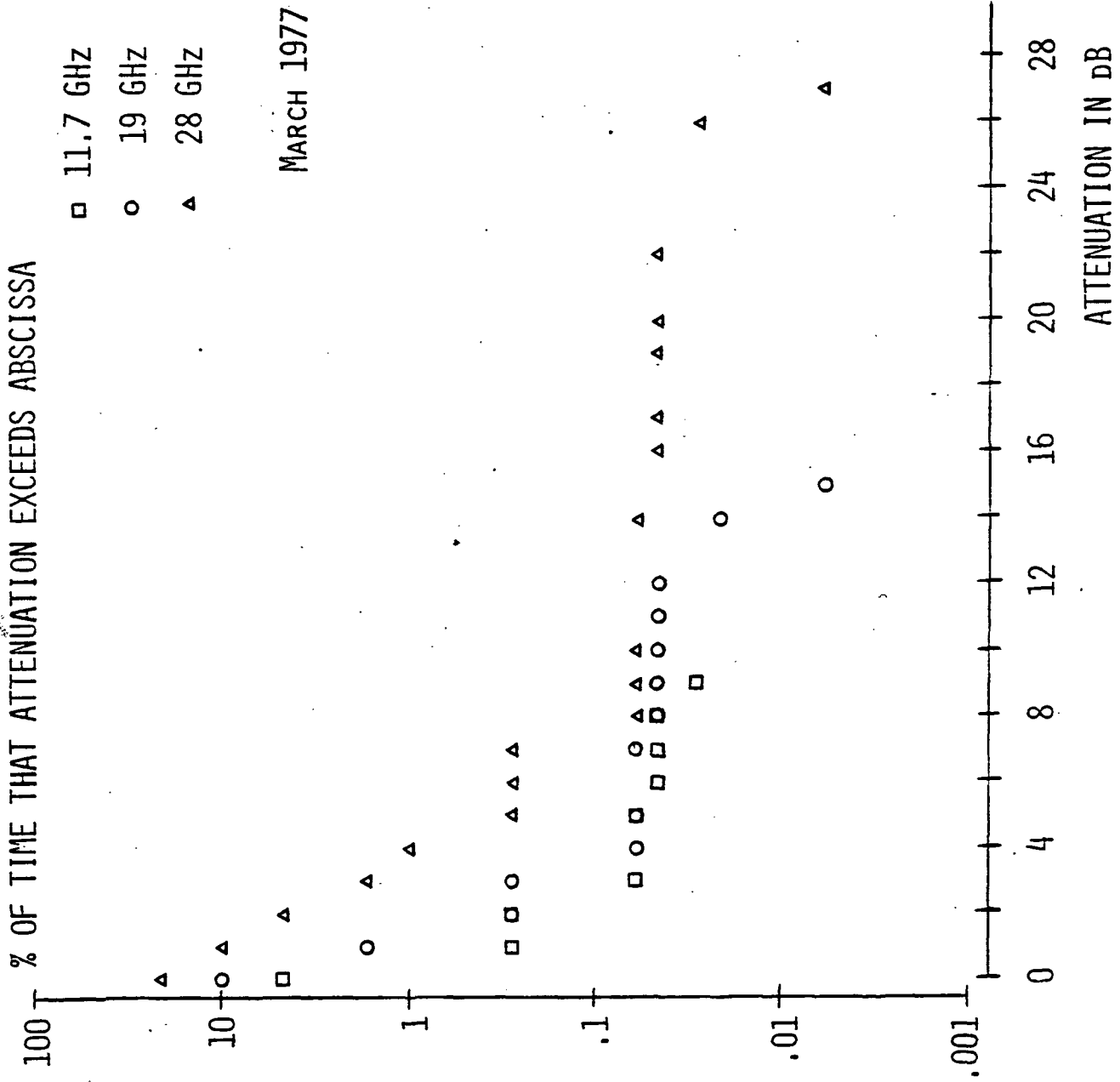


Figure 2.4-2. Attenuation for March 1977.  
(Values for 19 and 28 GHz are estimated from 11 GHz data.)

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| RAIN | ACIS | AV19 | AC28 | PER    |
|------|------|------|------|--------|
| .    | .    | .    | 0    | 23.367 |
| .    | .    | 0    | .    | 10.848 |
| .    | .    | .    | 1    | 9.155  |
| .    | 0    | .    | .    | 4.459  |
| .    | .    | .    | 2    | 4.446  |
| 0    | .    | .    | .    | 1.567  |
| .    | .    | 1    | 3    | 1.519  |
| .    | .    | .    | 4    | 1.104  |
| 1    | .    | .    | .    | 0.970  |
| 2    | .    | .    | .    | 0.676  |
| 3    | .    | .    | .    | 0.423  |
| 4    | .    | .    | .    | 0.315  |
| .    | 1    | 2    | .    | 0.281  |
| .    | .    | .    | 5    | 0.279  |
| .    | .    | .    | 6    | 0.273  |
| .    | .    | 3    | .    | 0.270  |
| .    | 2    | .    | 7    | 0.268  |
| 5    | .    | .    | .    | 0.255  |
| 6    | .    | .    | .    | 0.200  |
| 7    | .    | .    | .    | 0.168  |
| 8    | .    | .    | .    | 0.142  |
| 9    | .    | .    | .    | 0.115  |
| 10   | .    | .    | .    | 0.108  |
| 11   | .    | .    | .    | 0.103  |
| 12   | .    | .    | .    | 0.095  |
| 13   | .    | .    | .    | 0.087  |
| 14   | .    | .    | .    | 0.075  |
| 15   | .    | .    | .    | 0.069  |
| 16   | .    | 4    | 8    | 0.060  |
| .    | .    | .    | 9    | 0.059  |
| .    | 3    | 5    | 10   | 0.056  |
| .    | 5    | 7    | 14   | 0.053  |
| 17   | .    | .    | .    | 0.052  |
| .    | .    | 8    | 16   | 0.051  |
| 19   | 6    | 9    | 17   | 0.047  |
| .    | .    | 10   | 19   | 0.045  |
| .    | 7    | 11   | 20   | 0.044  |
| 20   | 8    | 12   | 22   | 0.042  |
| 21   | .    | .    | .    | 0.035  |
| 22   | .    | .    | .    | 0.031  |
| .    | 9    | .    | 26   | 0.030  |
| 24   | .    | .    | .    | 0.027  |
| 25   | .    | .    | .    | 0.025  |
| 26   | .    | .    | .    | 0.024  |
| 27   | .    | 14   | .    | 0.023  |
| 28   | .    | .    | .    | 0.022  |
| 29   | .    | .    | .    | 0.021  |
| 31   | .    | .    | .    | 0.020  |
| 32   | .    | .    | .    | 0.017  |
| 33   | .    | .    | .    | 0.016  |
| 34   | .    | .    | .    | 0.015  |
| 35   | .    | .    | .    | 0.014  |
| 36   | .    | .    | .    | 0.013  |
| 39   | .    | .    | .    | 0.012  |

Table 2.4-2. Attenuation and rain rate percent-of-time data for March, 1977. (Values for 19 and 28 GHz are estimated from 11 GHz data.)

| RAIN | AC15 | AV19 | AC28 | PER   |
|------|------|------|------|-------|
| 43   | .    | .    | .    | 0.010 |
| 45   | .    | .    | .    | 0.008 |
| 46   | .    | .    | .    | 0.007 |
| .    | .    | 15   | 27   | 0.006 |
| 48   | .    | .    | .    | 0.003 |
| 50   | .    | .    | .    | 0.001 |
| 60   | 10   | 16   | 29   | 0.000 |

Table 2.4-2 (continued). Attenuation and rain rate percent-of-time data for March, 1977. (Values for 19 and 28 GHz are estimated from 11 GHz data.)

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| ICFS     | PERCENT |
|----------|---------|
| 21.27999 | 0.004   |
| 22.07999 | 0.000   |
| 23.29    | 0.000   |
| 23.47999 | 0.010   |
| 24.68    | 0.027   |
| 24.88999 | 0.226   |
| 25.08999 | 0.228   |
| 25.28    | 0.037   |
| 25.49    | 1.113   |
| 25.68999 | 1.154   |
| 25.88001 | 1.391   |
| 25.88999 | 1.393   |
| 25.89001 | 1.500   |
| 26.09    | 1.741   |
| 26.29    | 2.216   |
| 26.68    | 2.391   |
| 26.88999 | 2.551   |
| 27.09    | 2.570   |
| 27.68    | 2.944   |
| 27.68999 | 2.940   |
| 27.88999 | 3.471   |
| 28.07999 | 3.026   |
| 28.29    | 4.026   |
| 28.48    | 4.228   |
| 28.49    | 4.236   |
| 28.68999 | 4.777   |
| 29.07999 | 4.347   |
| 29.09    | 4.697   |
| 29.29    | 4.781   |
| 29.40    | 4.792   |
| 29.49    | 4.845   |
| 29.68999 | 5.330   |
| 29.69001 | 5.546   |
| 29.88999 | 5.619   |
| 29.89001 | 5.620   |
| 30.08999 | 5.777   |
| 30.09    | 6.523   |
| 30.29    | 6.711   |
| 30.29999 | 6.712   |
| 30.49    | 8.263   |
| 30.68999 | 8.460   |
| 30.69001 | 8.651   |
| 30.7     | 8.969   |
| 30.88999 | 9.007   |
| 30.89001 | 9.833   |
| 31.08999 | 10.007  |
| 31.09    | 10.437  |
| 31.1     | 10.444  |
| 31.10001 | 10.501  |
| 31.29    | 11.149  |
| 31.30001 | 12.287  |
| 31.49    | 12.209  |
| 31.49001 | 12.637  |

Table 2.4-3. Percentage of time that 11.7 GHz isolation was less than the indicated value for March, 1977.

| ICTS     | PERCENT |
|----------|---------|
| 31.49999 | 12.705  |
| 31.50001 | 12.731  |
| 31.68999 | 12.758  |
| 31.69001 | 13.392  |
| 31.88999 | 13.404  |
| 31.89001 | 13.906  |
| 31.9     | 13.447  |
| 32.09    | 13.931  |
| 32.1     | 16.219  |
| 32.10001 | 16.462  |
| 32.29    | 16.737  |
| 32.30001 | 16.834  |
| 32.49    | 17.097  |
| 32.49001 | 17.250  |
| 32.49999 | 17.328  |
| 32.68999 | 18.262  |
| 32.69001 | 18.278  |
| 32.88999 | 18.632  |
| 32.7     | 19.348  |
| 32.88999 | 19.552  |
| 32.89001 | 20.365  |
| 32.9     | 21.552  |
| 33.08999 | 21.557  |
| 33.09    | 22.459  |
| 33.1     | 23.192  |
| 33.10001 | 23.260  |
| 33.29    | 23.687  |
| 33.29999 | 23.731  |
| 33.30001 | 23.963  |
| 33.49    | 25.144  |
| 33.49001 | 25.278  |
| 33.49999 | 25.574  |
| 33.50001 | 25.771  |
| 33.68999 | 26.346  |
| 33.69001 | 27.352  |
| 33.88999 | 27.950  |
| 33.7     | 28.439  |
| 33.88999 | 28.526  |
| 33.89001 | 28.977  |
| 33.9     | 30.039  |
| 34.08999 | 30.044  |
| 34.09    | 30.695  |
| 34.1     | 31.261  |
| 34.10001 | 31.613  |
| 34.29    | 33.298  |
| 34.29999 | 33.791  |
| 34.30001 | 34.032  |
| 34.49    | 34.405  |
| 34.49001 | 34.750  |
| 34.49999 | 36.419  |
| 34.50001 | 37.090  |
| 34.68999 | 37.279  |
| 34.69001 | 37.454  |
| 34.7     | 38.076  |
| 34.88999 | 38.943  |

Table 2.4-3 (continued). Percentage of time that 11.7 GHz isolation was less than the indicated value for March, 1977.



2.5 April, 1977

19 and 28 GHz attenuations are scaled.

Table 2.5-1.

Key parameters for the month of April, 1977.

1. Rain Data

VPI&SU Accumulation, 107.86 mm

USWS Accumulation, 120.14 mm

Peak VPI&SU Rate, 100.73 mm/hr

Percent of monthly accumulation at

R > 10 mm/hr, 19.5%      R > 20 mm/hr, 7.20%      R > 50 mm/hr, 1.21%

R > 30 mm/hr, 4.03%      R > 40 mm/hr, 2.22%

2. Signal Data

| Channel | Monthly Mean<br>Co Signal, dBm | Maximum Fade,<br>dB | Minimum Isolation<br>While in Phaselock, dB |
|---------|--------------------------------|---------------------|---------------------------------------------|
| 11.7    | -79.86                         | 16.84               | 10.27                                       |
| 19.04V  | -----                          | -----               | -----                                       |
| 19.04H  | -----                          | -----               | -----                                       |
| 28.56   | -80.76                         | lost lock           | -----                                       |



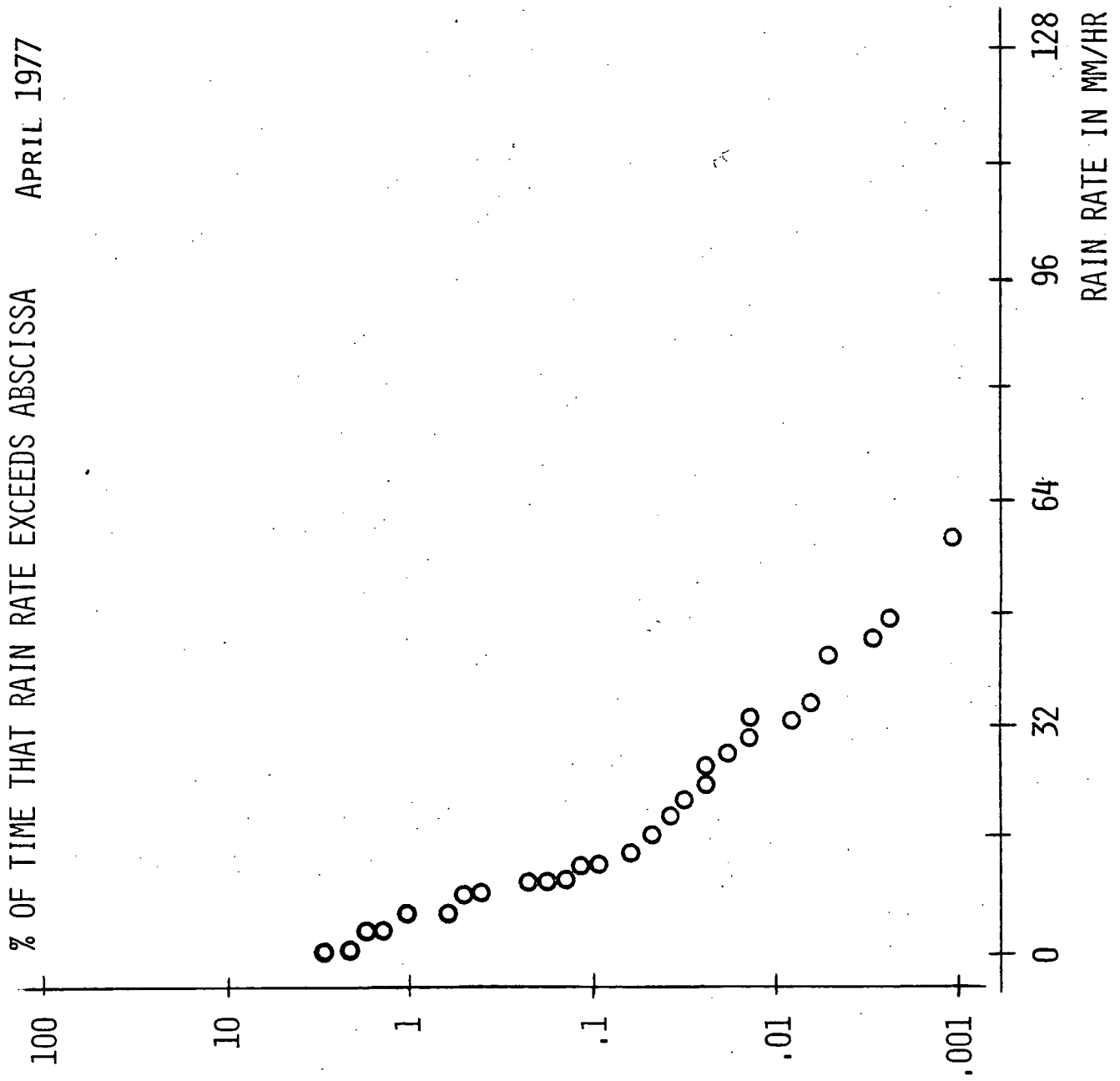


Figure 2.5-1. Rain rate statistics for April, 1977.

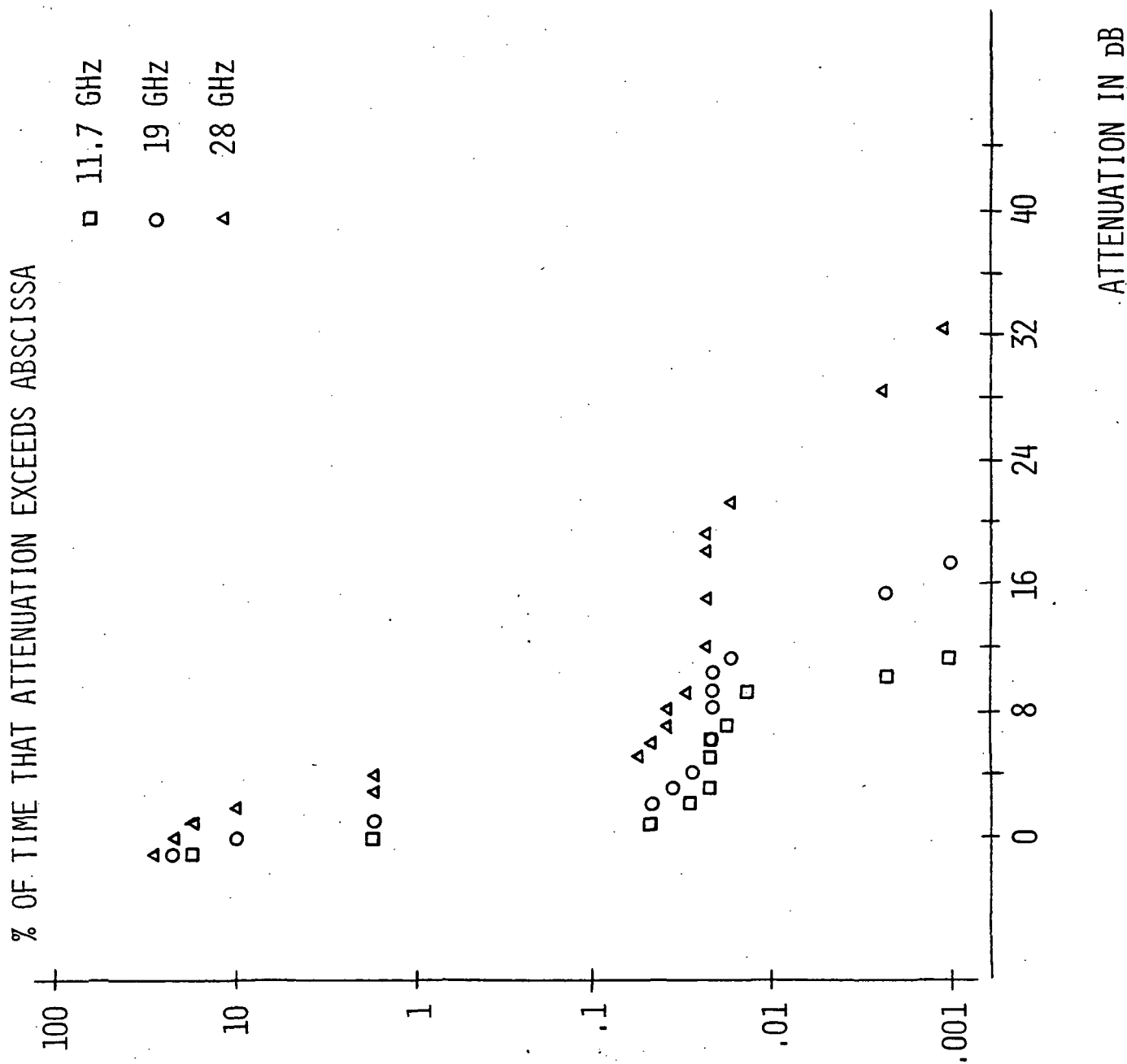


Figure 2.5-2. Attenuation statistics for April, 1977.  
(Values for 19 and 28 GHz are estimated from 11 GHz data)

| RAIN | AC12 | AV19 | AC28 | PER    |
|------|------|------|------|--------|
| .    | .    | .    | 0    | 24.907 |
| .    | .    | 0    | 1    | 19.828 |
| .    | 0    | .    | .    | 17.557 |
| .    | .    | .    | 2    | 16.913 |
| .    | .    | 1    | .    | 11.023 |
| .    | .    | .    | 3    | 11.021 |
| 0    | .    | .    | .    | 5.107  |
| 1    | .    | .    | .    | 2.437  |
| 2    | .    | 2    | 4    | 1.803  |
| .    | 1    | .    | 5    | 1.539  |
| .    | .    | .    | .    | 1.528  |
| 3    | .    | .    | .    | 1.525  |
| 4    | .    | .    | .    | 0.896  |
| 5    | .    | .    | .    | 0.588  |
| 6    | .    | .    | .    | 0.450  |
| 7    | .    | .    | .    | 0.337  |
| 8    | .    | .    | .    | 0.240  |
| 9    | .    | .    | .    | 0.179  |
| 10   | .    | .    | .    | 0.152  |
| 11   | .    | .    | .    | 0.091  |
| 12   | .    | .    | .    | 0.074  |
| 13   | .    | .    | .    | 0.067  |
| 14   | .    | .    | .    | 0.002  |
| .    | .    | .    | 6    | 0.001  |
| 15   | .    | .    | .    | 0.051  |
| 16   | .    | .    | .    | 0.044  |
| 17   | .    | .    | .    | 0.043  |
| .    | .    | 3    | .    | 0.041  |
| 18   | 2    | .    | 7    | 0.039  |
| .    | .    | .    | .    | 0.038  |
| 19   | .    | 4    | 8    | 0.035  |
| 20   | .    | .    | 9    | 0.034  |
| 21   | .    | .    | .    | 0.029  |
| 22   | .    | .    | .    | 0.027  |
| 23   | 0    | 5    | 10   | 0.023  |
| 24   | 0    | 6    | 14   | 0.024  |
| .    | 0    | 9    | 16   | 0.023  |
| 24   | .    | 10   | 19   | 0.021  |
| .    | 7    | 11   | 20   | 0.020  |
| 25   | .    | .    | .    | 0.019  |
| 27   | 8    | 12   | 22   | 0.017  |
| 28   | .    | .    | .    | 0.016  |
| 29   | .    | .    | .    | 0.014  |
| 30   | 10   | .    | .    | 0.013  |
| 32   | .    | .    | .    | 0.012  |
| 34   | .    | .    | .    | 0.007  |
| 35   | .    | .    | .    | 0.006  |
| 41   | .    | .    | .    | 0.005  |
| 43   | 11   | 16   | 29   | 0.002  |
| 60   | 14   | 21   | 39   | 0.001  |
| 100  | 16   | 24   | 45   | 0.000  |

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Table 2.5-2. Attenuation and rain rate percent-of-time data for April, 1977. (Values for 19 and 28 GHz are estimated from 11 GHz data.)

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| ICIS     | PERCENT |
|----------|---------|
| 10.27    | 0.002   |
| 22.08999 | 0.003   |
| 23.800   | 0.003   |
| 23.88999 | 0.006   |
| 24.49    | 0.008   |
| 24.800   | 0.011   |
| 24.88999 | 0.012   |
| 24.88001 | 0.014   |
| 25.28    | 0.017   |
| 25.29    | 0.019   |
| 26.28    | 0.022   |
| 26.48    | 0.025   |
| 26.88001 | 0.028   |
| 26.89001 | 0.028   |
| 27.07999 | 0.031   |
| 27.29    | 0.033   |
| 27.800   | 0.036   |
| 27.88    | 0.039   |
| 28.09    | 0.042   |
| 28.29    | 0.045   |
| 28.47999 | 0.050   |
| 28.48    | 0.054   |
| 28.49    | 0.056   |
| 28.88999 | 0.057   |
| 28.89001 | 0.060   |
| 29.08999 | 0.063   |
| 29.09    | 0.051   |
| 29.27999 | 0.054   |
| 29.28    | 0.065   |
| 29.29    | 1.174   |
| 29.49    | 1.004   |
| 29.49001 | 1.802   |
| 29.88999 | 1.945   |
| 29.89999 | 2.433   |
| 29.89001 | 2.877   |
| 30.08999 | 2.970   |
| 30.09    | 3.000   |
| 30.29    | 3.000   |
| 30.29999 | 3.059   |
| 30.49    | 3.062   |
| 30.49001 | 3.479   |
| 30.49999 | 6.220   |
| 30.88999 | 6.250   |
| 30.89    | 6.410   |
| 30.88999 | 6.508   |
| 30.89001 | 6.737   |
| 30.9     | 6.909   |
| 31.09    | 7.120   |
| 31.1     | 7.750   |
| 31.10001 | 8.504   |
| 31.29    | 8.799   |
| 31.29999 | 9.174   |
| 31.49    | 9.810   |

Table 2.5-3. Percentage of time that 11.7 GHz isolation was less than the indicated value for April, 1977.

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| LOTS     | PERCENT |
|----------|---------|
| 31.44001 | 10.749  |
| 31.44999 | 10.750  |
| 31.50001 | 10.905  |
| 31.64001 | 11.379  |
| 31.64999 | 11.377  |
| 31.7     | 13.221  |
| 31.68999 | 13.491  |
| 31.89001 | 13.528  |
| 31.9     | 13.827  |
| 32.09    | 13.890  |
| 32.1     | 16.673  |
| 32.10001 | 16.770  |
| 32.29    | 17.919  |
| 32.29999 | 18.480  |
| 32.30001 | 18.507  |
| 32.49    | 18.570  |
| 32.49001 | 18.630  |
| 32.49999 | 20.702  |
| 32.50001 | 22.402  |
| 32.68999 | 22.540  |
| 32.69001 | 22.613  |
| 32.69999 | 24.493  |
| 32.7     | 24.814  |
| 32.88999 | 25.019  |
| 32.89001 | 25.225  |
| 32.9     | 26.843  |
| 33.09    | 27.204  |
| 33.1     | 27.524  |
| 33.10001 | 27.570  |
| 33.29    | 27.850  |
| 33.29999 | 29.607  |
| 33.30001 | 29.932  |
| 33.49    | 31.132  |
| 33.49001 | 31.142  |
| 33.49999 | 31.344  |
| 33.50001 | 31.719  |
| 33.68999 | 32.029  |
| 33.69001 | 32.183  |
| 33.69999 | 33.631  |
| 33.7     | 34.523  |
| 33.89001 | 34.590  |
| 33.9     | 34.794  |
| 34.09    | 35.341  |
| 34.1     | 36.657  |
| 34.29    | 37.639  |
| 34.29999 | 38.450  |
| 34.30001 | 38.910  |
| 34.49    | 39.104  |
| 34.49001 | 39.251  |
| 34.49999 | 40.550  |
| 34.50001 | 41.513  |
| 34.68999 | 41.541  |
| 34.69001 | 41.600  |
| 34.69999 | 41.719  |
| 34.7     | 42.450  |
| 34.88999 |         |

Table 2.5-3 (continued). Percentage of time that 11.7 GHz isolation was less than the indicated value for April, 1977.

Table 2.5-4. Regression equations for the month of April, 1977.

| Relationship                                                   | 11.7 GHz                       |                |                | 19.04 GHz |                |                | 28.56 GHz |                |                |
|----------------------------------------------------------------|--------------------------------|----------------|----------------|-----------|----------------|----------------|-----------|----------------|----------------|
|                                                                | Equation                       | N <sub>s</sub> | R <sup>2</sup> | Equation  | N <sub>s</sub> | R <sup>2</sup> | Equation  | N <sub>s</sub> | R <sup>2</sup> |
| I on log <sub>10</sub> (A)<br>for 3 < A < 30                   | $I = 24.46 + 7.57 \log_{10} A$ | 31             | .07            | ID        |                |                | ID        |                |                |
| A on R at equal<br>probability levels.                         | $A = 0.84 * R^{.66}$           | 5              | .82            | ID        |                |                | ID        |                |                |
| Attenuation scaling.<br>A (11) at equal<br>probability levels. | ID                             |                |                | ID        |                |                | ID        |                |                |
| Attenuation scaling.<br>A (19) at equal<br>probability levels. | ID                             |                |                | ID        |                |                | ID        |                |                |
| Attenuation scaling.<br>A (28) at equal<br>probability levels. | ID                             |                |                | ID        |                |                | ID        |                |                |

2.6 May, 1977

19 GHz attenuation values are scaled. 28 GHz isolation data are suspect because of an antenna defect.

Table 2.6-1.

Key parameters for the month of May, 1977.

1. Rain Data

VPI&SU Accumulation, 49.63 mm

USWS Accumulation, 67.06 mm

Peak VPI&SU Rate, 133.90 mm/hr

Percent of monthly accumulation at

|                      |                      |                     |
|----------------------|----------------------|---------------------|
| R > 10 mm/hr, 60.00% | R > 20 mm/hr, 42.27% | R > 50 mm/hr, 13.08 |
| R > 30 mm/hr, 30.18% | R > 40 mm/hr, 19.14% |                     |

2. Signal Data

| Channel | Monthly Mean<br>Co Signal, dBm | Maximum Fade,<br>dB | Minimum Isolation<br>While in Phaselock, dB |
|---------|--------------------------------|---------------------|---------------------------------------------|
| 11.7    | -80.20                         | 30.11               | 16.67                                       |
| 19.04V  | -81.04                         | 44.56(s)            | -----                                       |
| 19.04H  | -84.01                         | -----               | -----                                       |
| 28.56   | -85.96                         | 81.60               | -----                                       |



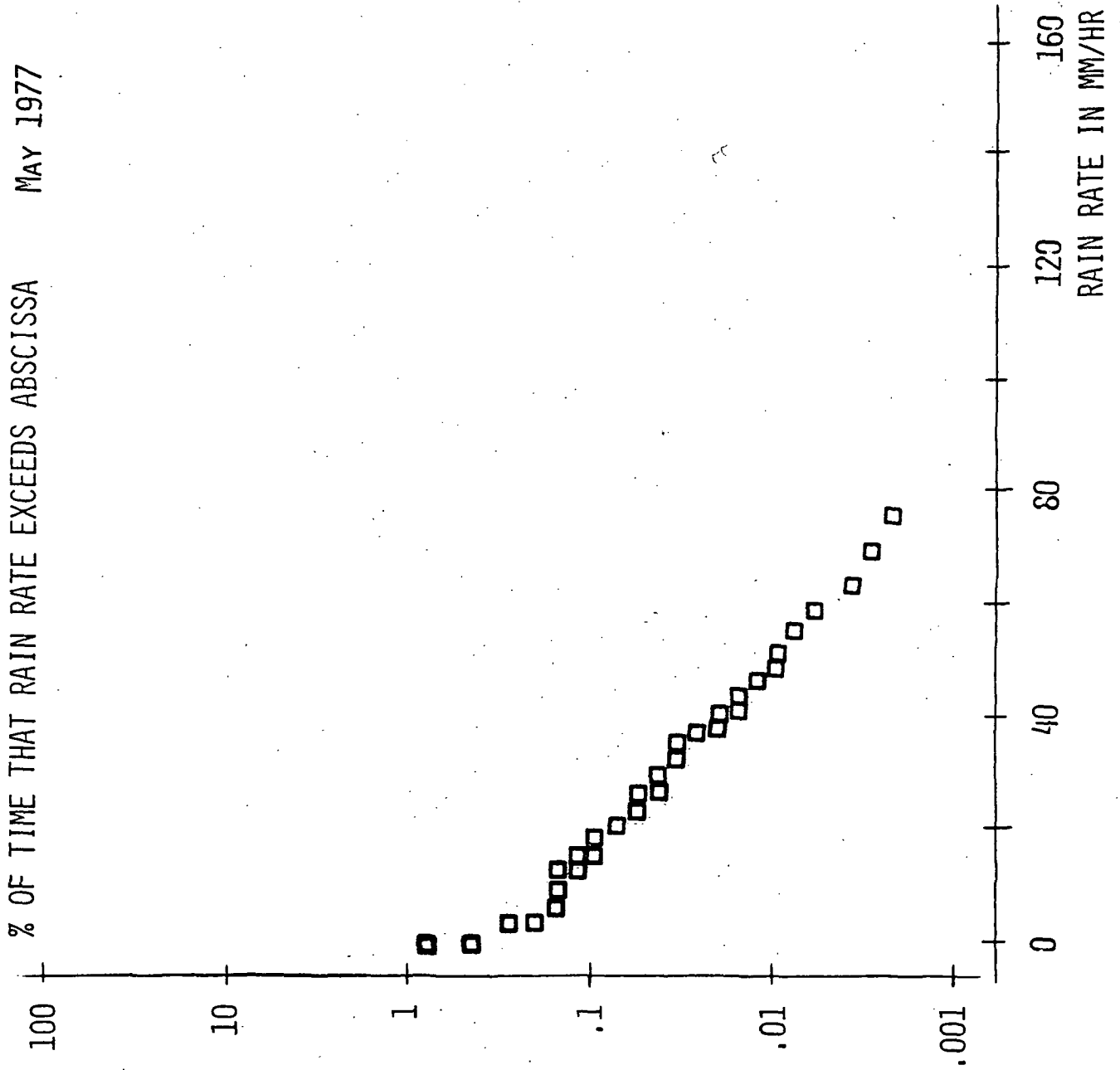


Figure 2.6-1. Rain rate statistics for May, 1977.

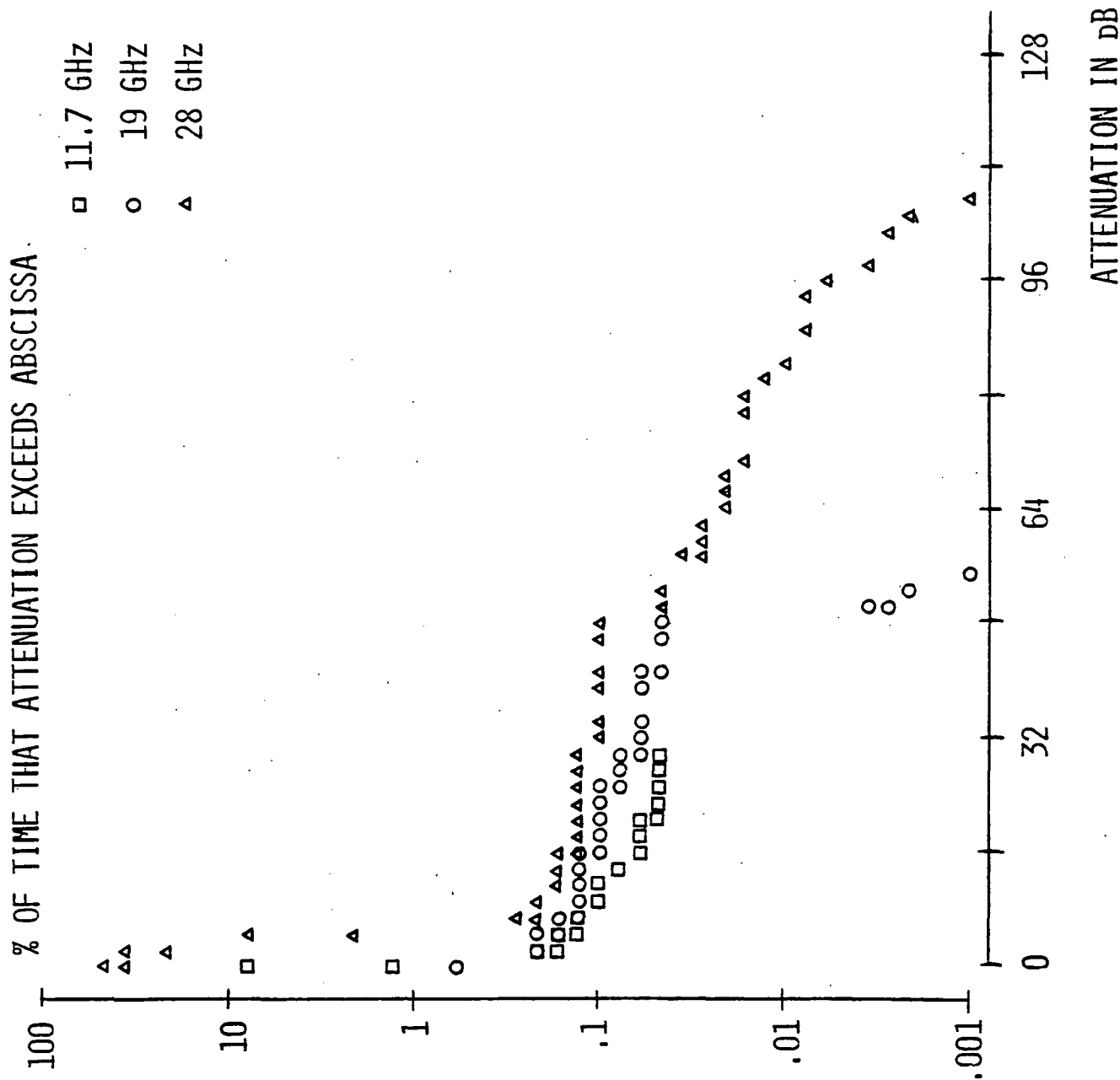


Figure 2.6-2. Attenuation statistics for May, 1977.  
(Values for 19 GHz are estimated.)

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| RAIN | ACTS | AV19 | AC28 | PER    |
|------|------|------|------|--------|
| .    | .    | .    | 0    | 42.021 |
| .    | .    | .    | 1    | 40.289 |
| .    | .    | .    | 2    | 34.380 |
| .    | .    | .    | 3    | 20.604 |
| .    | 0    | .    | 4    | 7.576  |
| .    | .    | .    | 5    | 6.837  |
| .    | 1    | .    | .    | 2.223  |
| 0    | .    | .    | .    | 1.227  |
| .    | .    | 0    | .    | 0.765  |
| .    | .    | 1    | .    | 0.603  |
| 1    | .    | .    | .    | 0.575  |
| 2    | .    | .    | .    | 0.425  |
| 3    | .    | .    | .    | 0.312  |
| .    | .    | .    | 6    | 0.271  |
| .    | .    | .    | 7    | 0.268  |
| .    | .    | 2    | .    | 0.243  |
| .    | 2    | .    | 8    | 0.239  |
| .    | .    | 3    | .    | 0.227  |
| 4    | .    | .    | 9    | 0.216  |
| .    | .    | .    | 10   | 0.213  |
| .    | .    | 4    | .    | 0.211  |
| 5    | .    | .    | 11   | 0.201  |
| 6    | .    | .    | .    | 0.197  |
| .    | .    | 5    | .    | 0.188  |
| 7    | .    | .    | .    | 0.186  |
| .    | .    | .    | 12   | 0.180  |
| .    | 3    | .    | 13   | 0.179  |
| .    | .    | 6    | .    | 0.177  |
| 8    | .    | .    | 14   | 0.171  |
| .    | 4    | .    | .    | 0.168  |
| 10   | .    | .    | 15   | 0.167  |
| 11   | .    | 7    | .    | 0.160  |
| .    | .    | .    | 16   | 0.151  |
| 12   | 5    | 8    | .    | 0.148  |
| .    | .    | 9    | 17   | 0.147  |
| .    | .    | .    | 18   | 0.145  |
| .    | 0    | 10   | 21   | 0.142  |
| .    | .    | 11   | 23   | 0.141  |
| .    | .    | .    | 24   | 0.137  |
| 13   | .    | 12   | 25   | 0.136  |
| .    | .    | 13   | 27   | 0.132  |
| .    | 7    | .    | .    | 0.129  |
| .    | .    | 14   | 28   | 0.128  |
| .    | .    | 15   | 29   | 0.128  |
| 14   | .    | 16   | 30   | 0.123  |
| .    | .    | .    | 33   | 0.122  |
| .    | 8    | .    | .    | 0.119  |
| .    | .    | .    | .    | 0.118  |
| .    | .    | .    | .    | 0.117  |
| .    | .    | .    | .    | 0.114  |
| .    | .    | .    | .    | 0.111  |
| .    | .    | .    | .    | 0.110  |
| .    | .    | .    | .    | 0.109  |

Table 2.6-2. Attenuation and rain rate  
percent-of-time data for  
May, 1977.  
Note: 19 GHz points are  
scaled.

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| RAIN | ACTS | AV19 | AC28 | PER   |
|------|------|------|------|-------|
| 15   | .    | 17   | 35   | 0.108 |
| .    | .    | .    | 38   | 0.102 |
| .    | 9    | 19   | 39   | 0.101 |
| .    | 10   | 20   | 41   | 0.100 |
| 16   | .    | 22   | 45   | 0.099 |
| .    | .    | .    | 46   | 0.096 |
| .    | 11   | 23   | 47   | 0.095 |
| .    | .    | 24   | 48   | 0.094 |
| .    | 12   | 25   | .    | 0.093 |
| 17   | .    | .    | .    | 0.092 |
| 18   | 13   | 26   | .    | 0.087 |
| .    | .    | 28   | .    | 0.081 |
| 19   | .    | .    | .    | 0.074 |
| .    | 14   | 29   | .    | 0.073 |
| 20   | 15   | 30   | .    | 0.068 |
| 21   | .    | 32   | .    | 0.065 |
| .    | 16   | 33   | .    | 0.064 |
| 22   | .    | .    | .    | 0.063 |
| .    | .    | 34   | .    | 0.062 |
| .    | 17   | 35   | .    | 0.061 |
| 23   | .    | 38   | .    | 0.059 |
| 24   | 19   | 39   | .    | 0.058 |
| 25   | .    | .    | .    | 0.057 |
| .    | 20   | 41   | .    | 0.056 |
| .    | 21   | 42   | .    | 0.052 |
| .    | 22   | 45   | 50   | 0.050 |
| 26   | 23   | 46   | .    | 0.049 |
| 27   | .    | 48   | .    | 0.046 |
| .    | 24   | 49   | .    | 0.047 |
| .    | 25   | .    | .    | 0.046 |
| 28   | 26   | .    | 53   | 0.045 |
| .    | 27   | .    | .    | 0.044 |
| .    | 30   | .    | .    | 0.043 |
| 29   | .    | .    | .    | 0.041 |
| .    | .    | .    | 56   | 0.039 |
| 30   | .    | .    | 57   | 0.038 |
| 31   | .    | .    | .    | 0.036 |
| 33   | .    | .    | .    | 0.035 |
| 34   | .    | .    | .    | 0.031 |
| .    | .    | .    | 58   | 0.030 |
| 35   | .    | .    | .    | 0.029 |
| .    | .    | .    | 60   | 0.028 |
| .    | .    | .    | 61   | 0.026 |
| 36   | .    | .    | .    | 0.024 |
| 37   | .    | .    | 65   | 0.022 |
| .    | .    | .    | 67   | 0.021 |
| 38   | .    | .    | .    | 0.020 |
| 40   | .    | .    | 69   | 0.019 |
| 41   | .    | .    | 70   | 0.018 |
| 43   | .    | .    | 77   | 0.017 |
| 44   | .    | .    | 79   | 0.016 |
| 45   | .    | .    | .    | 0.015 |
| 46   | .    | .    | 82   | 0.013 |
| 48   | .    | .    | .    | 0.012 |

Table 2.6-2 (continued). Attenuation and rain rate percent-of-time data for May, 1977.  
Note: 19 GHz points are scaled.

| RAIN | ACTS | AV19 | AC28 | PER   |
|------|------|------|------|-------|
| 49   | .    | .    | 85   | 0.011 |
| 51   | .    | .    | 90   | 0.009 |
| 52   | .    | .    | 93   | 0.008 |
| 54   | .    | .    | 97   | 0.007 |
| 59   | .    | .    | 99   | 0.006 |
| 63   | .    | 50   | 102  | 0.004 |
| 75   | .    | 51   | 105  | 0.003 |
| 102  | .    | 52   | 108  | 0.002 |
| 112  | .    | 54   | 120  | 0.001 |
| 155  | 50   | 60   |      | 0.000 |

Table 2.6-2 (continued). Attenuation and rain rate percent-of-time data for May, 1977.  
Note: 19 GHz points are scaled.

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| ICIS     | PERCENT |
|----------|---------|
| 16.00    | 0.002   |
| 17.40    | 0.004   |
| 17.60    | 0.007   |
| 17.80    | 0.011   |
| 17.88001 | 0.012   |
| 18.07999 | 0.016   |
| 18.40    | 0.016   |
| 18.60999 | 0.019   |
| 18.80    | 0.028   |
| 19.27999 | 0.032   |
| 19.40    | 0.037   |
| 19.47999 | 0.042   |
| 19.48    | 0.046   |
| 19.80    | 0.049   |
| 19.88    | 0.053   |
| 19.88001 | 0.055   |
| 20.08001 | 0.060   |
| 20.20    | 0.062   |
| 20.29    | 0.064   |
| 20.40    | 0.067   |
| 20.49    | 0.071   |
| 20.60    | 0.074   |
| 20.88    | 0.078   |
| 21.27999 | 0.085   |
| 21.20    | 0.086   |
| 21.29    | 0.095   |
| 21.60    | 0.101   |
| 21.80999 | 0.104   |
| 22.09    | 0.106   |
| 22.27999 | 0.108   |
| 22.20    | 0.109   |
| 22.49    | 0.115   |
| 22.68999 | 0.115   |
| 23.40    | 0.116   |
| 24.08999 | 0.118   |
| 24.09    | 0.120   |
| 24.29    | 0.127   |
| 24.49    | 0.131   |
| 25.68999 | 0.136   |
| 26.29    | 0.141   |
| 26.49    | 0.145   |
| 26.80001 | 0.152   |
| 26.89001 | 0.157   |
| 27.09    | 0.291   |
| 27.29    | 0.300   |
| 27.40    | 1.283   |
| 27.50    | 1.284   |
| 27.69001 | 1.288   |
| 27.80999 | 1.305   |
| 27.89001 | 1.307   |
| 28.07999 | 2.079   |
| 28.08999 | 2.902   |
| 28.09    | 3.591   |

Table 2.6-3. Percentage of time that 11.7 GHz isolation was less than the indicated value for May, 1977.

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| ICTS     | PERCENT |
|----------|---------|
| 28.23    | 4.199   |
| 28.29    | 5.181   |
| 28.48    | 5.187   |
| 28.49    | 5.537   |
| 28.49001 | 7.134   |
| 28.88    | 7.136   |
| 28.88999 | 7.296   |
| 28.88    | 9.212   |
| 28.88001 | 9.507   |
| 28.88999 | 11.570  |
| 28.89001 | 11.690  |
| 29.07999 | 12.589  |
| 29.09    | 13.073  |
| 29.28    | 13.340  |
| 29.29    | 13.160  |
| 29.40    | 13.160  |
| 29.49    | 13.344  |
| 29.49001 | 13.710  |
| 29.88    | 16.200  |
| 29.88999 | 18.170  |
| 29.89001 | 18.480  |
| 29.88999 | 19.423  |
| 29.89001 | 20.250  |
| 30.08999 | 20.300  |
| 30.09    | 21.785  |
| 30.29    | 22.292  |
| 30.29999 | 22.414  |
| 30.49    | 23.618  |
| 30.49001 | 23.722  |
| 30.49999 | 24.102  |
| 30.88999 | 24.708  |
| 30.89001 | 24.897  |
| 30.89999 | 25.800  |
| 30.9     | 26.034  |
| 30.88999 | 26.842  |
| 30.89001 | 26.222  |
| 30.9     | 27.637  |
| 31.09    | 28.034  |
| 31.1     | 28.501  |
| 31.10001 | 28.790  |
| 31.29    | 29.287  |
| 31.29999 | 29.520  |
| 31.30001 | 29.504  |
| 31.49    | 31.040  |
| 31.49001 | 31.180  |
| 31.49999 | 31.310  |
| 31.50001 | 31.809  |
| 31.89001 | 32.000  |
| 31.9     | 32.921  |
| 31.88999 | 32.931  |
| 31.89001 | 33.020  |
| 31.9     | 33.437  |
| 32.09    | 33.231  |
| 32.1     | 34.700  |
| 32.29    | 35.004  |

Table 2.6-3 (continued). Percentage of time that 11.7 GHz isolation was less than the indicated value for May, 1977.

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| ICTS     | PERCENT |
|----------|---------|
| 32.29999 | 36.795  |
| 32.30001 | 37.326  |
| 32.49001 | 38.125  |
| 32.49999 | 39.047  |
| 32.50001 | 39.592  |
| 32.68999 | 39.802  |
| 32.69001 | 40.460  |
| 32.7     | 41.237  |
| 32.88999 | 42.380  |
| 32.89001 | 43.250  |
| 32.9     | 43.750  |
| 33.09    | 44.282  |
| 33.1     | 45.389  |
| 33.10001 | 45.589  |
| 33.29    | 46.092  |
| 33.29999 | 47.817  |
| 33.30001 | 49.117  |
| 33.49    | 49.807  |
| 33.49001 | 49.810  |
| 33.50001 | 50.133  |
| 33.68999 | 51.956  |
| 33.69001 | 52.861  |
| 33.7     | 53.423  |
| 33.88999 | 53.605  |
| 33.89001 | 53.894  |
| 33.9     | 55.782  |
| 34.09    | 56.066  |
| 34.1     | 56.503  |
| 34.10001 | 56.964  |
| 34.29    | 57.274  |
| 34.30001 | 57.994  |
| 34.49    | 59.095  |
| 34.49001 | 59.245  |
| 34.49999 | 59.471  |
| 34.50001 | 59.621  |
| 34.68999 | 60.259  |
| 34.69001 | 60.709  |
| 34.69999 | 61.314  |
| 34.7     | 62.560  |
| 34.88999 | 62.562  |
| 34.89001 | 62.763  |
| 34.9     | 64.687  |
| 35.09    | 64.920  |
| 35.1     | 65.243  |
| 35.29    | 65.868  |
| 35.29999 | 66.017  |
| 35.30001 | 66.155  |
| 35.49    | 66.968  |
| 35.49001 | 67.012  |
| 35.49999 | 69.048  |
| 35.50001 | 69.521  |
| 35.68999 | 69.724  |
| 35.69001 | 69.870  |
| 35.69999 | 69.974  |
| 35.7     | 71.103  |

Table 2.6-3 (continued). Percentage of time that 11.7 GHz isolation was less than the indicated value for May, 1977.



Table 2.6-4. Regression equations for the month of May, 1977.

| Relationship                                                | 11.7 GHz                           |                |                | 19.04 GHz                    |                |                | 28.56 GHz                          |                |                |
|-------------------------------------------------------------|------------------------------------|----------------|----------------|------------------------------|----------------|----------------|------------------------------------|----------------|----------------|
|                                                             | Equation                           | N <sub>s</sub> | R <sup>2</sup> | Equation                     | N <sub>s</sub> | R <sup>2</sup> | Equation                           | N <sub>s</sub> | R <sup>2</sup> |
| I on log <sub>10</sub> (A)<br>for 3 < A < 30                | $I = 38.24 - 15.38^* \log_{10}(A)$ | 156            | .86            | ID                           |                |                | $I = 37.07 - 11.95^* \log_{10}(A)$ | 30432          | .10            |
| A on R at equal probability levels.                         | $A = 3.16^* R^{.56}$               | 5              | .87            | $A = 5.33^* R^{.53}$         | 14             | .62            | $A = 5.69^* R^{.67}$               | 19             | .89            |
| Attenuation scaling.<br>A (11) at equal probability levels. |                                    |                |                | $A(11) = .40^* A(19)^{1.07}$ | 16             | .93            | $A(11) = .09^* A(28)^{1.32}$       | 8              | .89            |
| Attenuation scaling.<br>A (19) at equal probability levels. | $A(19) = 2.77^* A(11)^{.88}$       | 16             | .93            |                              |                |                | $A(19) = .44^* A(28)^{1.04}$       | 20             | .96            |
| Attenuation scaling.<br>A (28) at equal probability levels. | $A(28) = 7.44^* A(11)^{.68}$       | 8              | .89            | $A(28) = 2.49^* A(19)^{.92}$ | 20             | .96            |                                    |                |                |

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2.7 June, 1977

28 GHz isolation data are suspect because of an antenna defect.

Table 2.7-1.

Key parameters for the month of June, 1977.

1. Rain Data

VPI&SU Accumulation, 105.22 mm

USWS Accumulation, 145.54 mm

Peak VPI&SU Rate, 136.57 mm/hr

Percent of monthly accumulation at

|                      |                      |                      |
|----------------------|----------------------|----------------------|
| R > 10 mm/hr, 41.92% | R > 20 mm/hr, 31.40% | R > 50 mm/hr, 14.46% |
| R > 30 mm/hr, 24.77% | R > 40 mm/hr, 18.95% |                      |

2. Signal Data

| Channel | Monthly Mean<br>Co Signal, dBm | Maximum Fade,<br>dB | Minimum Isolation<br>While in Phaselock, dB |
|---------|--------------------------------|---------------------|---------------------------------------------|
| 11.7    | -79.59                         | 14.08               | 17.67                                       |
| 19.04V  | -83.39                         | 20.85               | -----                                       |
| 19.04H  | -85.07                         | -----               | -----                                       |
| 28.56   | -81.47                         | 38.18               | -----                                       |

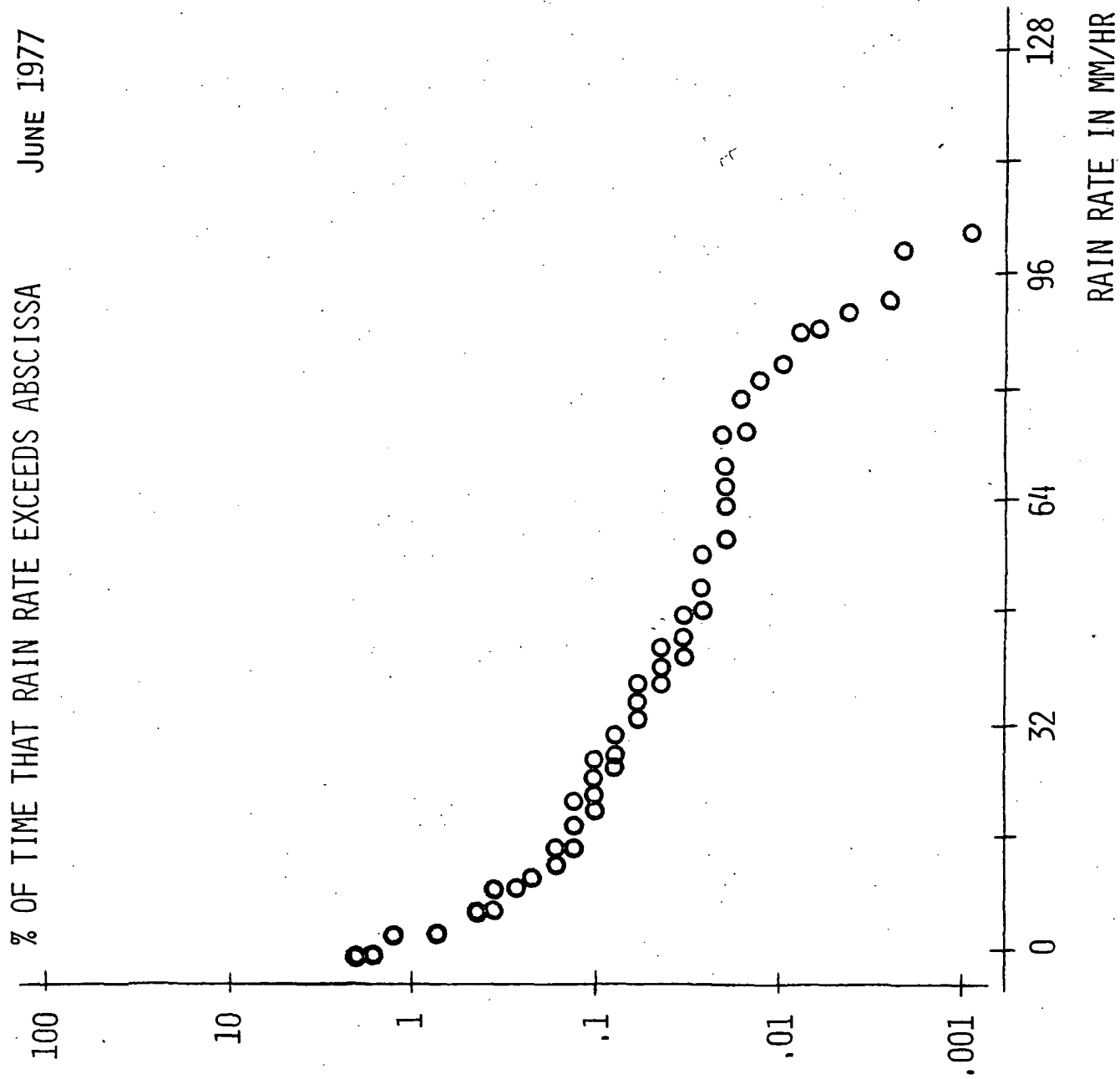


Figure 2.7-1. Rain rate statistics for June, 1977.

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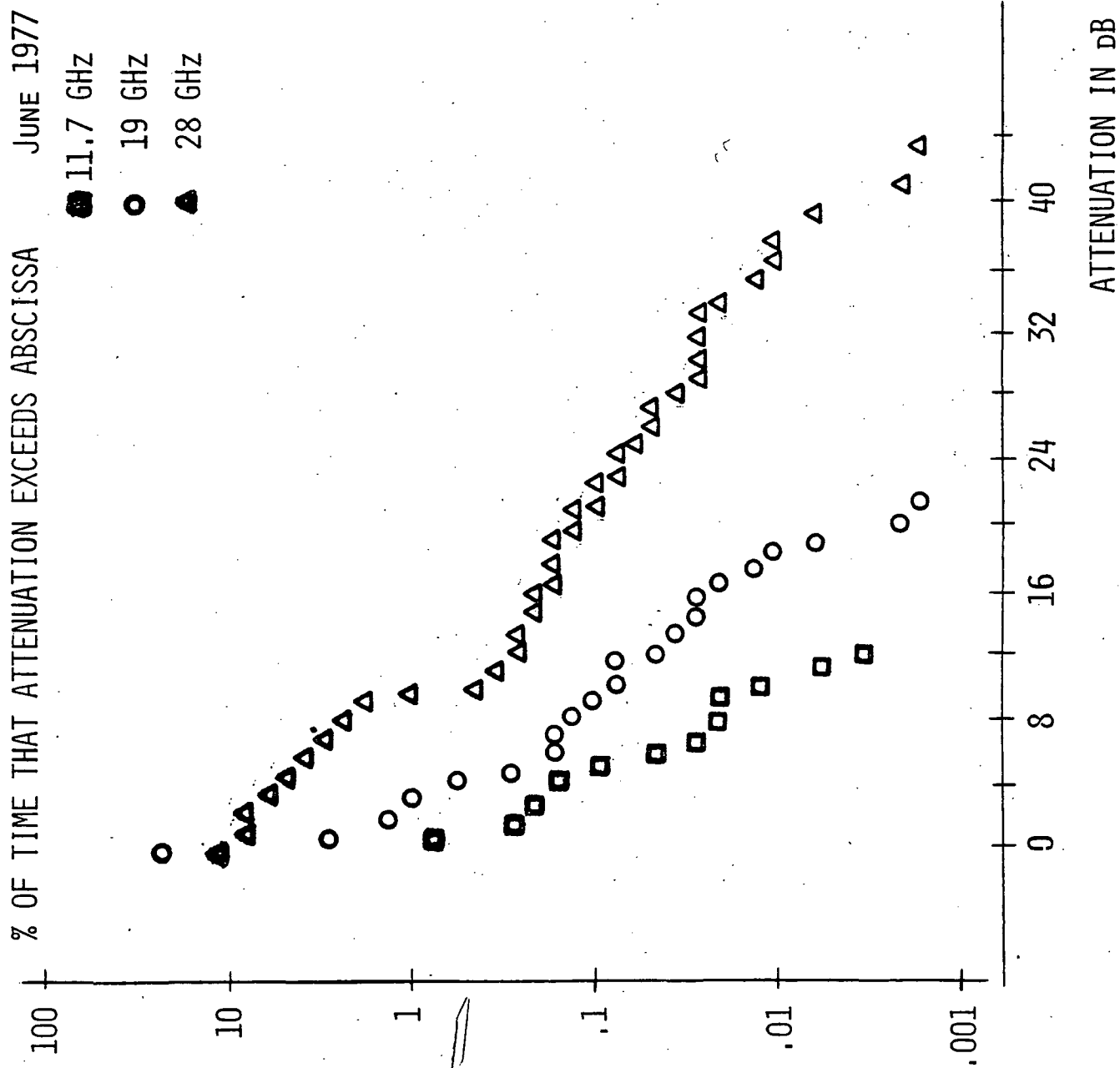


Figure 2.7-2. Attenuation statistics for June, 1977.

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| RAIN | ACTS | AV19 | AC28 | PER    |
|------|------|------|------|--------|
| .    | .    | 0    | .    | 25.500 |
| .    | .    | .    | 0    | 13.228 |
| .    | 0    | .    | .    | 10.283 |
| .    | .    | .    | 1    | 9.966  |
| .    | .    | .    | 2    | 9.207  |
| .    | .    | .    | 3    | 8.105  |
| .    | .    | .    | 4    | 5.901  |
| .    | .    | .    | 5    | 4.739  |
| .    | .    | .    | 6    | 3.662  |
| 0    | .    | .    | 7    | 2.944  |
| .    | .    | .    | 8    | 2.344  |
| 1    | .    | .    | .    | 1.661  |
| .    | .    | 1    | 9    | 1.441  |
| 2    | .    | .    | .    | 1.386  |
| .    | 1    | .    | .    | 1.152  |
| .    | .    | 2    | .    | 1.102  |
| 3    | .    | .    | .    | 0.752  |
| .    | .    | 3    | .    | 0.697  |
| .    | .    | .    | 10   | 0.530  |
| 4    | .    | .    | .    | 0.524  |
| .    | .    | 4    | .    | 0.465  |
| .    | .    | .    | 11   | 0.420  |
| 5    | .    | .    | .    | 0.398  |
| .    | .    | 5    | .    | 0.371  |
| .    | 2    | .    | .    | 0.350  |
| 6    | .    | .    | .    | 0.339  |
| .    | .    | .    | 12   | 0.324  |
| 7    | .    | .    | .    | 0.306  |
| .    | 3    | .    | 13   | 0.282  |
| 8    | .    | .    | .    | 0.247  |
| .    | .    | 6    | .    | 0.237  |
| .    | .    | .    | 14   | 0.236  |
| 9    | .    | .    | .    | 0.227  |
| 10   | .    | .    | .    | 0.220  |
| .    | 4    | .    | 15   | 0.200  |
| .    | .    | 7    | .    | 0.198  |
| 11   | .    | .    | 16   | 0.186  |
| .    | .    | .    | .    | 0.179  |
| .    | .    | 8    | .    | 0.173  |
| 12   | .    | .    | 17   | 0.163  |
| 13   | .    | .    | .    | 0.161  |
| .    | .    | .    | .    | 0.155  |
| 14   | .    | .    | 18   | 0.147  |
| .    | .    | .    | .    | 0.140  |
| 15   | .    | 9    | .    | 0.139  |
| .    | .    | .    | .    | 0.136  |
| 16   | .    | .    | 19   | 0.127  |
| .    | .    | .    | .    | 0.126  |
| .    | 5    | .    | .    | 0.123  |
| .    | .    | .    | 20   | 0.121  |
| 17   | .    | .    | .    | 0.120  |
| .    | .    | 10   | .    | 0.113  |
| .    | .    | .    | .    | 0.109  |

Table 2.7-2. Attenuation and rain rate  
percent-of-time data for  
June, 1977.

| RAIN | ACTS | AV19 | AL28 | PER   |
|------|------|------|------|-------|
| 18   | .    | .    | .    | 0.106 |
| 19   | .    | .    | 21   | 0.105 |
| 20   | .    | .    | .    | 0.101 |
| 21   | .    | .    | .    | 0.097 |
| 22   | .    | .    | .    | 0.091 |
| .    | .    | 11   | 22   | 0.089 |
| 23   | .    | .    | .    | 0.086 |
| 24   | .    | .    | .    | 0.082 |
| 25   | .    | .    | .    | 0.080 |
| 26   | .    | .    | .    | 0.076 |
| .    | .    | .    | 23   | 0.075 |
| 27   | .    | .    | .    | 0.074 |
| 28   | .    | .    | .    | 0.071 |
| 29   | .    | 12   | .    | 0.066 |
| 30   | .    | .    | .    | 0.061 |
| 32   | 6    | .    | 24   | 0.059 |
| 33   | .    | .    | .    | 0.056 |
| 34   | .    | .    | .    | 0.054 |
| 35   | .    | .    | 25   | 0.053 |
| 36   | .    | .    | .    | 0.050 |
| 37   | .    | .    | .    | 0.046 |
| 38   | .    | 13   | .    | 0.045 |
| .    | .    | .    | 26   | 0.043 |
| 39   | .    | 14   | .    | 0.042 |
| 40   | .    | .    | .    | 0.039 |
| .    | 7    | .    | .    | 0.036 |
| 41   | .    | .    | .    | 0.035 |
| 42   | .    | 15   | .    | 0.034 |
| 43   | .    | .    | .    | 0.032 |
| .    | 8    | .    | .    | 0.031 |
| 45   | .    | .    | .    | 0.030 |
| .    | .    | .    | 27   | 0.029 |
| 46   | .    | .    | .    | 0.028 |
| 49   | 9    | .    | .    | 0.027 |
| 52   | .    | 16   | .    | 0.025 |
| 56   | .    | .    | 28   | 0.023 |
| 57   | .    | .    | .    | 0.022 |
| 58   | .    | .    | 29   | 0.021 |
| 62   | .    | .    | .    | 0.019 |
| 74   | .    | .    | .    | 0.017 |
| 75   | .    | 17   | .    | 0.016 |
| 76   | .    | .    | 31   | 0.015 |
| 78   | 10   | .    | .    | 0.014 |
| 83   | .    | 18   | 32   | 0.013 |
| 84   | .    | .    | 33   | 0.010 |
| 85   | 11   | .    | 34   | 0.009 |
| .    | .    | 19   | .    | 0.008 |
| 87   | .    | .    | .    | 0.007 |
| .    | .    | .    | 35   | 0.006 |
| 88   | 12   | 20   | .    | 0.005 |
| 89   | .    | 21   | 36   | 0.003 |
| 90   | .    | .    | 41   | 0.002 |
| 105  | 13   | 22   | 45   | 0.001 |
| 136  | 14   | 23   | 47   | 0.000 |

Table 2.7-2 (continued). Attenuation and rain rate percent-of-time data for June, 1977.

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| ICIS     | PERCENT |
|----------|---------|
| 17.66999 | 0.005   |
| 18.46999 | 0.007   |
| 19.07999 | 0.014   |
| 19.88001 | 0.016   |
| 20.48    | 0.017   |
| 20.68    | 0.018   |
| 20.88    | 0.022   |
| 21.08001 | 0.025   |
| 21.28    | 0.026   |
| 21.88    | 0.027   |
| 22.07999 | 0.029   |
| 22.29    | 0.034   |
| 22.68    | 0.035   |
| 22.88    | 0.038   |
| 22.88999 | 0.041   |
| 23.09    | 0.042   |
| 23.68    | 0.046   |
| 23.68999 | 0.047   |
| 24.08001 | 0.050   |
| 24.28    | 0.056   |
| 24.29    | 0.058   |
| 24.48    | 0.060   |
| 24.49    | 0.061   |
| 25.29    | 0.068   |
| 25.49    | 0.073   |
| 25.68    | 0.075   |
| 25.88999 | 0.080   |
| 26.09    | 0.095   |
| 26.49    | 0.099   |
| 26.69001 | 0.111   |
| 26.88    | 0.112   |
| 26.88999 | 0.114   |
| 26.89001 | 0.120   |
| 27.07999 | 0.130   |
| 27.08001 | 0.137   |
| 27.09    | 0.140   |
| 27.29    | 0.143   |
| 27.48    | 0.144   |
| 27.49    | 0.150   |
| 27.49001 | 0.165   |
| 27.68    | 0.211   |
| 27.68999 | 0.220   |
| 27.69001 | 0.810   |
| 27.88    | 0.912   |
| 27.88001 | 0.914   |
| 27.88999 | 3.293   |
| 27.89001 | 3.293   |
| 28.07999 | 4.044   |
| 28.08001 | 4.060   |
| 28.09    | 5.985   |
| 28.28    | 5.986   |
| 28.29    | 6.928   |
| 28.48    | 7.238   |

Table 2.7-3. Percentage of time that 11.7 GHz isolation was less than the indicated value for June, 1977.



| ICIS     | PERCENT |
|----------|---------|
| 28.49    | 10.880  |
| 28.49001 | 10.867  |
| 28.68    | 11.460  |
| 28.68999 | 14.120  |
| 28.69001 | 15.730  |
| 28.88    | 15.971  |
| 28.88001 | 16.338  |
| 28.88999 | 17.384  |
| 28.89001 | 17.405  |
| 29.08999 | 18.019  |
| 29.09    | 18.129  |
| 29.27999 | 18.433  |
| 29.28    | 18.600  |
| 29.29    | 20.622  |
| 29.48    | 20.737  |
| 29.49    | 23.506  |
| 29.49001 | 25.084  |
| 29.68    | 25.231  |
| 29.68999 | 28.567  |
| 29.69001 | 28.564  |
| 29.88999 | 28.814  |
| 29.89001 | 28.823  |
| 30.08999 | 29.178  |
| 30.09    | 30.169  |
| 30.29    | 31.599  |
| 30.29999 | 34.368  |
| 30.49    | 35.399  |
| 30.49001 | 35.767  |
| 30.49999 | 36.528  |
| 30.68999 | 36.544  |
| 30.69001 | 36.557  |
| 30.69999 | 36.588  |
| 30.7     | 36.591  |
| 30.88999 | 36.893  |
| 30.89001 | 37.191  |
| 30.9     | 37.667  |
| 31.08999 | 38.019  |
| 31.09    | 38.452  |
| 31.1     | 40.355  |
| 31.10001 | 41.390  |
| 31.29    | 42.185  |
| 31.29999 | 43.159  |
| 31.49    | 43.181  |
| 31.49001 | 43.183  |
| 31.49999 | 43.201  |
| 31.68999 | 43.371  |
| 31.69001 | 43.527  |
| 31.69999 | 43.719  |
| 31.7     | 44.122  |
| 31.88999 | 44.120  |
| 31.89001 | 44.410  |
| 31.9     | 48.299  |
| 32.08999 | 48.300  |
| 32.09    | 49.615  |
| 32.1     | 50.914  |

Table 2.7-3 (continued). Percentage of time that 11.7 GHz isolation was less than the indicated value for June, 1977.

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| ICTS     | PERCENT |
|----------|---------|
| 32.29    | 50.953  |
| 32.29999 | 51.059  |
| 32.30001 | 51.248  |
| 32.49    | 51.616  |
| 32.49001 | 51.617  |
| 32.49999 | 51.891  |
| 32.50001 | 52.203  |
| 32.68999 | 52.330  |
| 32.69001 | 52.423  |
| 32.69999 | 52.623  |
| 32.7     | 56.466  |
| 32.88999 | 56.651  |
| 32.89001 | 57.648  |
| 32.9     | 58.452  |
| 33.08999 | 58.454  |
| 33.09    | 58.514  |
| 33.1     | 60.189  |
| 33.29    | 60.901  |
| 33.29999 | 61.382  |
| 33.30001 | 62.244  |
| 33.49    | 62.517  |
| 33.49001 | 62.575  |
| 33.49999 | 64.823  |
| 33.50001 | 65.429  |
| 33.68999 | 65.696  |
| 33.69001 | 66.079  |
| 33.69999 | 66.328  |
| 33.7     | 66.821  |
| 33.88999 | 66.827  |
| 33.89001 | 67.526  |
| 33.9     | 69.660  |
| 34.08999 | 69.663  |
| 34.09    | 70.264  |
| 34.1     | 71.259  |
| 34.10001 | 71.640  |
| 34.29    | 72.316  |
| 34.29999 | 73.980  |
| 34.30001 | 74.415  |
| 34.49    | 74.492  |
| 34.49999 | 74.983  |
| 34.50001 | 75.133  |
| 34.68999 | 75.178  |
| 34.69001 | 75.740  |
| 34.7     | 76.348  |
| 34.88999 | 76.349  |
| 34.89001 | 76.964  |
| 34.9     | 78.297  |
| 35.09    | 78.706  |
| 35.1     | 79.753  |
| 35.29    | 79.936  |
| 35.29999 | 80.399  |
| 35.30001 | 81.050  |
| 35.49    | 81.104  |
| 35.49001 | 81.446  |
| 35.49999 | 81.599  |

Table 2.7-3 (continued). Percentage of time that 11.7 GHz isolation was less than the indicated value for June, 1977.

Table 2.7-4. Regression equations for the month of June, 1977.

| Relationship                                             | 11.7 GHz                           |                |                | 19.04 GHz                        |                |                | 28.56 GHz                         |                |                |
|----------------------------------------------------------|------------------------------------|----------------|----------------|----------------------------------|----------------|----------------|-----------------------------------|----------------|----------------|
|                                                          | Equation                           | N <sub>s</sub> | R <sup>2</sup> | Equation                         | N <sub>s</sub> | R <sup>2</sup> | Equation                          | N <sub>s</sub> | R <sup>2</sup> |
| I on log <sub>10</sub> (A) for 3 < A < 30                | $I = 39.51 - 15.43^* \log_{10}(A)$ | 283            | .33            | $I = 29.44 - 5.8^* \log_{10}(A)$ | 255            | .05            | $I = 23.70 - 1.32^* \log_{10}(A)$ | 323            | .00            |
| A on R at equal probability levels.                      | $A = .88^* R^{.57}$                | 6              | .95            | $A = 2.84^* R^{.43}$             | 10             | .95            | $A = 5.77^* R^{.41}$              | 12             | .88            |
| Attenuation scaling. A (11) at equal probability levels. |                                    |                |                | ID                               |                |                | $A(11) = .15^* A(28)^{1.17}$      | 5              | .99            |
| Attenuation scaling. A (19) at equal probability levels. | ID                                 |                |                |                                  |                |                | $A(19) = .63^* A(28)^{.85}$       | 4              | .93            |
| Attenuation scaling. A (28) at equal probability levels. | $A(28) = 5^* A(11)^{.84}$          | 5              | .99            | $A(28) = 2.05^* A(19)^{.98}$     | 4              | .93            |                                   |                |                |

2.8 July, 1977

All data collected are valid.

Table 2.8-1.

Key parameters for the month of July, 1977.

1. Rain Data

VPI&SU Accumulation, 48.67 mm

USWS Accumulation, 50.8 mm

Peak VPI&SU Rate, 201.10 mm/hr

Percent of monthly accumulation at

|                      |                      |                      |
|----------------------|----------------------|----------------------|
| R > 10 mm/hr, 71.65% | R > 20 mm/hr, 69.14% | R > 50 mm/hr, 56.20% |
| R > 30 mm/hr, 67.77% | R > 40 mm/hr, 64.61% |                      |

2. Signal Data

| Channel | Monthly Mean<br>Co Signal, dBm | Maximum Fade,<br>dB | Minimum Isolation<br>While in Phaselock, dB |
|---------|--------------------------------|---------------------|---------------------------------------------|
| 11.7    | -81.69                         | 50                  | 11.07                                       |
| 19.04V  | -85.96                         | 57.26               | *                                           |
| 19.04H  | -86.92                         | 57.26               | *                                           |
| 28.56   | -81.70                         | 114.52              | **                                          |

\* System was not yet in operation.

\*\* Antenna problems invalidated data.

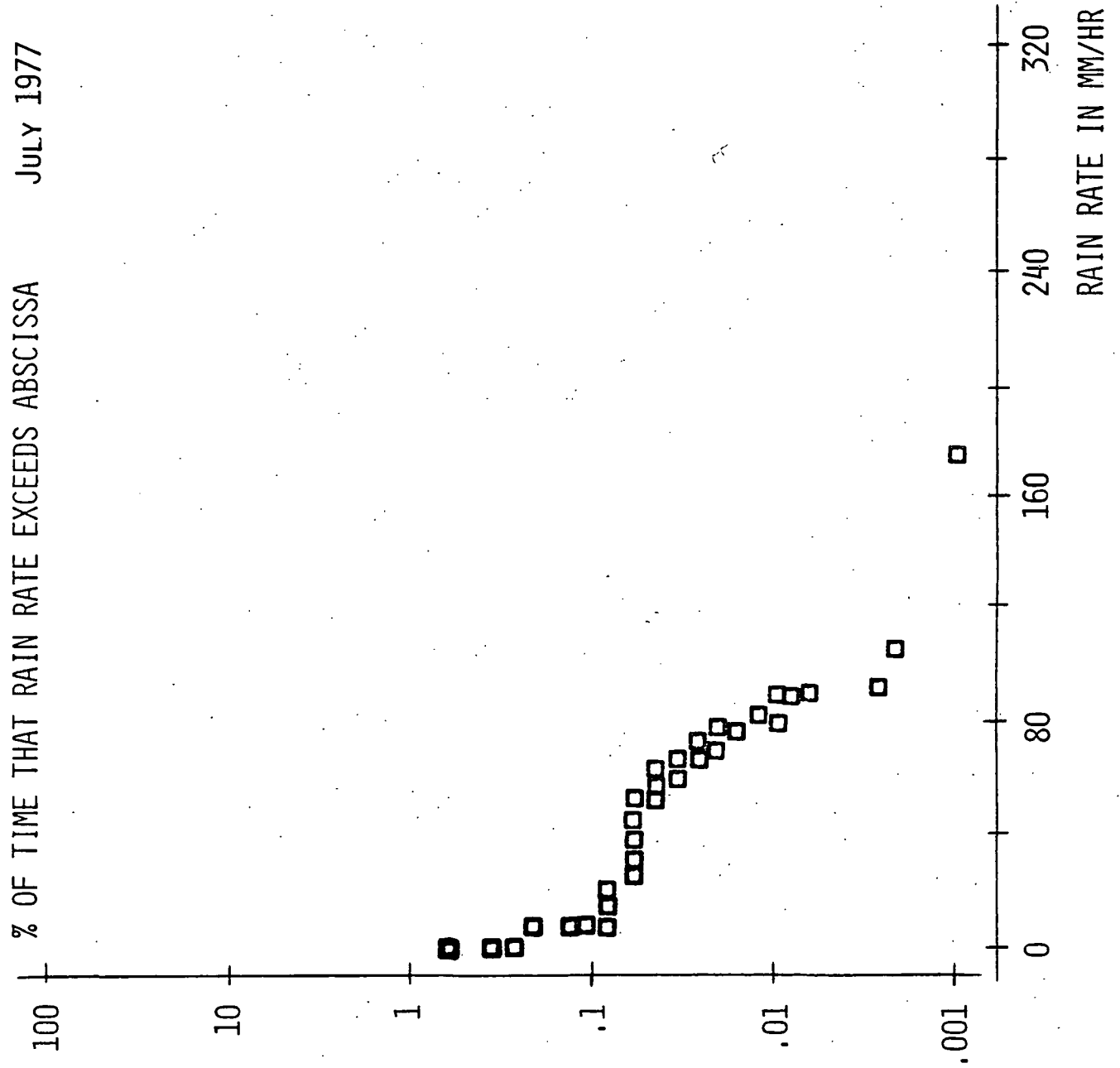


Figure 2.8-1. Rain rate statistics for July, 1977.

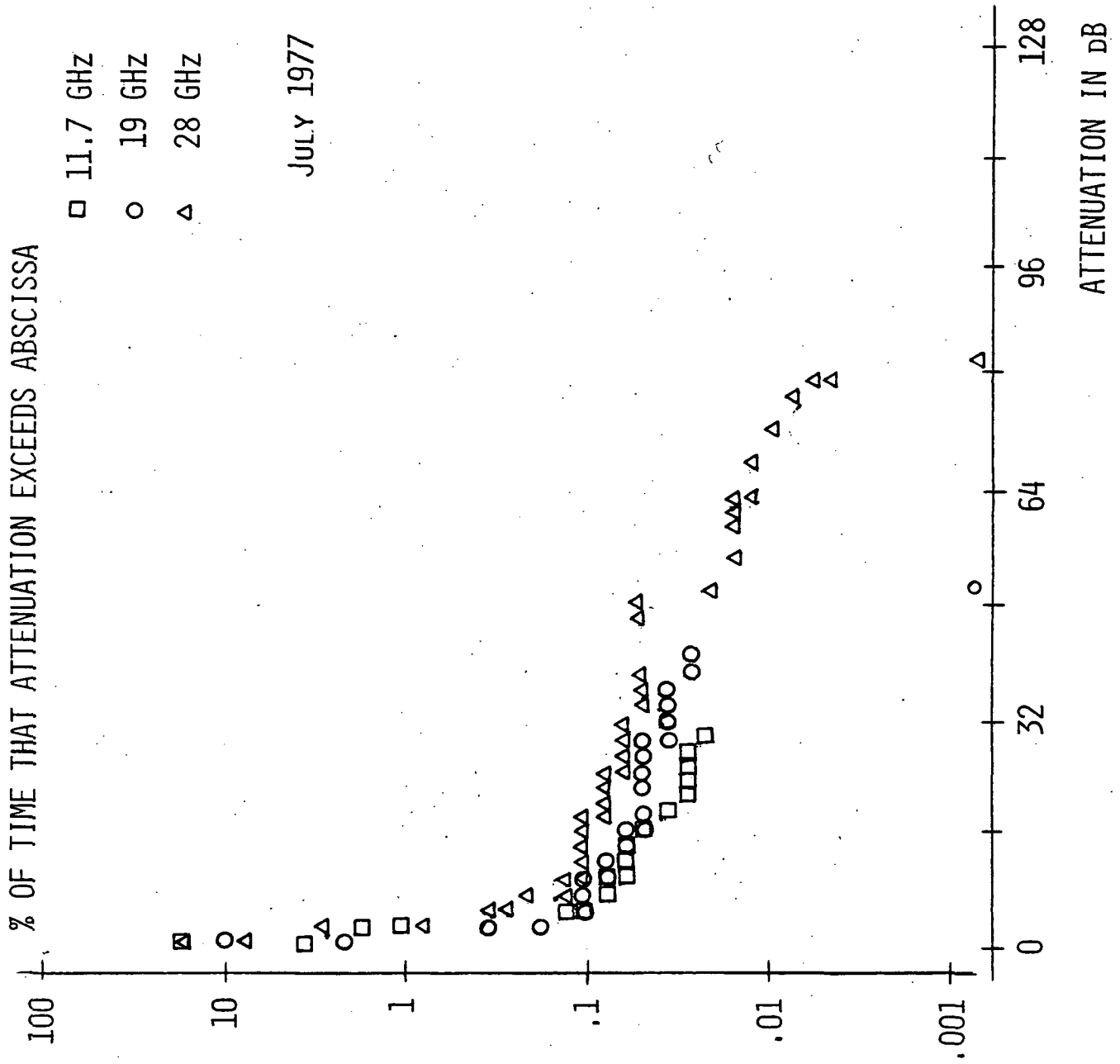


Figure 2.8-2. Attenuation statistics for July, 1977.

| RAIN | ACTS | AV19 | AC28 | PER    |
|------|------|------|------|--------|
| .    | 0    | .    | 0    | 23.338 |
| .    | .    | .    | .    | 19.957 |
| .    | .    | 0    | .    | 15.422 |
| .    | 1    | .    | 1    | 9.274  |
| .    | .    | .    | 2    | 5.303  |
| .    | .    | 1    | .    | 3.266  |
| .    | 2    | .    | .    | 2.971  |
| .    | 3    | .    | .    | 1.999  |
| 0    | .    | .    | 3    | 0.963  |
| .    | .    | .    | .    | 0.872  |
| .    | .    | .    | 4    | 0.517  |
| 1    | .    | 2    | .    | 0.427  |
| .    | .    | .    | .    | 0.422  |
| 2    | .    | .    | 5    | 0.344  |
| .    | .    | .    | .    | 0.317  |
| 3    | .    | .    | 6    | 0.262  |
| .    | .    | .    | .    | 0.211  |
| .    | .    | 3    | .    | 0.186  |
| .    | .    | .    | 7    | 0.176  |
| .    | 4    | .    | .    | 0.149  |
| .    | .    | .    | 8    | 0.133  |
| .    | .    | 4    | .    | 0.132  |
| .    | .    | .    | 9    | 0.120  |
| .    | .    | 5    | .    | 0.111  |
| .    | .    | .    | .    | 0.110  |
| 4    | .    | 6    | .    | 0.109  |
| .    | .    | .    | 10   | 0.108  |
| .    | 5    | .    | .    | 0.106  |
| 5    | .    | .    | .    | 0.105  |
| .    | .    | .    | 11   | 0.101  |
| .    | .    | .    | 12   | 0.100  |
| .    | 6    | 7    | 13   | 0.097  |
| .    | 7    | 8    | .    | 0.095  |
| 6    | .    | .    | .    | 0.092  |
| .    | 8    | .    | 14   | 0.091  |
| .    | .    | 9    | .    | 0.090  |
| 7    | .    | 10   | 15   | 0.088  |
| .    | 9    | .    | 18   | 0.086  |
| .    | 10   | .    | .    | 0.084  |
| 8    | 11   | .    | .    | 0.083  |
| .    | .    | 11   | 19   | 0.082  |
| .    | 12   | .    | 20   | 0.080  |
| .    | .    | .    | 21   | 0.078  |
| 10   | .    | 12   | .    | 0.076  |
| .    | .    | .    | 22   | 0.075  |
| .    | 14   | .    | .    | 0.072  |
| 13   | .    | 13   | .    | 0.071  |
| 15   | .    | 15   | 23   | 0.069  |
| 24   | .    | .    | .    | 0.068  |
| 27   | .    | .    | .    | 0.067  |
| 29   | .    | .    | 24   | 0.066  |
| 31   | .    | .    | 26   | 0.065  |
| 34   | 15   | 16   | 27   | 0.064  |
| .    | .    | 18   | .    | 0.063  |

Table 2.8-2. Attenuation and rain rate  
percent-of-time data for  
July, 1977.



| RAIN | ACTS | AV19 | AC28 | PER   |
|------|------|------|------|-------|
| 37   | .    | 19   | .    | 0.062 |
| 38   | .    | .    | 31   | 0.060 |
| 39   | .    | 22   | 33   | 0.059 |
| .    | 16   | 24   | 36   | 0.058 |
| 41   | .    | .    | 39   | 0.057 |
| 42   | .    | 25   | 45   | 0.056 |
| .    | .    | 26   | .    | 0.055 |
| .    | 17   | .    | .    | 0.054 |
| 43   | .    | 28   | .    | 0.053 |
| 46   | .    | 30   | .    | 0.050 |
| 47   | 18   | 31   | .    | 0.049 |
| .    | .    | 32   | .    | 0.048 |
| 48   | .    | 33   | .    | 0.047 |
| .    | .    | 34   | .    | 0.046 |
| 50   | .    | 35   | .    | 0.045 |
| 51   | 19   | 36   | .    | 0.044 |
| 54   | .    | 37   | .    | 0.043 |
| .    | .    | 38   | .    | 0.040 |
| 56   | .    | 39   | .    | 0.039 |
| .    | .    | .    | .    | 0.038 |
| 57   | 20   | .    | .    | 0.037 |
| .    | 21   | 40   | .    | 0.036 |
| 58   | 23   | .    | .    | 0.035 |
| 59   | 24   | .    | .    | 0.034 |
| .    | 25   | .    | .    | 0.032 |
| 60   | 27   | 41   | .    | 0.031 |
| 63   | 28   | .    | .    | 0.030 |
| 64   | .    | .    | .    | 0.029 |
| 65   | .    | .    | 50   | 0.026 |
| 70   | .    | .    | 51   | 0.025 |
| .    | .    | .    | 56   | 0.024 |
| .    | .    | .    | 57   | 0.022 |
| .    | .    | .    | 60   | 0.021 |
| 75   | .    | .    | 61   | 0.020 |
| .    | .    | .    | 63   | 0.019 |
| .    | .    | .    | 64   | 0.018 |
| 76   | .    | .    | 66   | 0.017 |
| 79   | .    | .    | 68   | 0.016 |
| 80   | .    | .    | 70   | 0.015 |
| .    | .    | .    | 72   | 0.013 |
| .    | .    | .    | 74   | 0.012 |
| 81   | .    | .    | .    | 0.011 |
| .    | .    | .    | 77   | 0.010 |
| 85   | .    | .    | .    | 0.009 |
| 86   | .    | .    | 79   | 0.008 |
| 91   | .    | .    | .    | 0.007 |
| 92   | .    | .    | 80   | 0.006 |
| 93   | .    | .    | .    | 0.004 |
| 112  | .    | .    | .    | 0.003 |
| 113  | .    | .    | .    | 0.002 |
| 198  | .    | 50   | 83   | 0.001 |
| 201  | 50   | 57   | 114  | 0.000 |

Table 2.8-2 (continued). Attenuation and rain rate  
percent-of-time data for  
July, 1977.

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| ICTS     | PERCENT |
|----------|---------|
| 11.07    | 0.001   |
| 11.28    | 0.002   |
| 11.47001 | 0.004   |
| 11.66999 | 0.005   |
| 11.67    | 0.006   |
| 12.07    | 0.007   |
| 12.46999 | 0.016   |
| 12.48    | 0.017   |
| 13.07    | 0.020   |
| 13.07999 | 0.021   |
| 13.68    | 0.022   |
| 13.87    | 0.024   |
| 14.07999 | 0.026   |
| 14.67    | 0.028   |
| 15.28    | 0.031   |
| 15.48    | 0.032   |
| 15.88    | 0.034   |
| 16.08001 | 0.035   |
| 16.48    | 0.037   |
| 16.68    | 0.043   |
| 16.88    | 0.044   |
| 17.07999 | 0.045   |
| 17.08001 | 0.047   |
| 17.28    | 0.048   |
| 17.47999 | 0.050   |
| 17.48    | 0.051   |
| 17.87    | 0.052   |
| 18.68    | 0.055   |
| 19.27    | 0.056   |
| 19.27999 | 0.060   |
| 19.46    | 0.062   |
| 19.68    | 0.088   |
| 19.88    | 0.089   |
| 20.07999 | 0.091   |
| 20.28    | 0.095   |
| 20.68    | 0.097   |
| 20.68999 | 0.098   |
| 21.07999 | 0.100   |
| 21.08001 | 0.109   |
| 21.09    | 0.110   |
| 21.47999 | 0.127   |
| 21.48    | 0.130   |
| 21.68    | 0.136   |
| 21.88    | 0.141   |
| 21.88001 | 0.151   |
| 21.89001 | 0.153   |
| 22.07999 | 0.157   |
| 22.27999 | 0.658   |
| 22.46    | 0.641   |
| 22.68    | 0.662   |
| 22.88999 | 0.663   |
| 23.07999 | 0.956   |
| 23.08001 | 0.958   |

Table 2.8-3. Percentage of time that 11.7 GHz isolation was less than the indicated value for July, 1977.

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| IGTS     | PERCENT |
|----------|---------|
| 23.47999 | 1.067   |
| 23.48    | 1.103   |
| 23.68999 | 1.106   |
| 23.88    | 1.193   |
| 23.88999 | 1.226   |
| 24.27999 | 1.315   |
| 24.49    | 1.325   |
| 24.49    | 1.326   |
| 24.68    | 1.996   |
| 24.68999 | 2.197   |
| 25.07999 | 2.234   |
| 25.08999 | 2.397   |
| 25.27999 | 2.413   |
| 25.28    | 2.414   |
| 25.29    | 2.466   |
| 25.41999 | 2.745   |
| 25.48    | 3.038   |
| 25.49    | 3.049   |
| 25.88999 | 3.198   |
| 25.89001 | 3.199   |
| 26.07999 | 3.434   |
| 26.08001 | 3.435   |
| 26.09    | 3.714   |
| 26.27999 | 4.108   |
| 26.28    | 4.273   |
| 26.29    | 4.278   |
| 26.68    | 4.424   |
| 26.68999 | 4.447   |
| 26.68    | 5.122   |
| 26.88999 | 5.141   |
| 26.89001 | 5.251   |
| 27.08999 | 5.657   |
| 27.09    | 5.835   |
| 27.27999 | 5.906   |
| 27.49    | 5.945   |
| 27.48    | 6.432   |
| 27.49    | 6.550   |
| 27.68999 | 7.121   |
| 27.69001 | 7.151   |
| 27.88001 | 7.152   |
| 27.88999 | 7.476   |
| 27.89001 | 7.857   |
| 28.07999 | 8.315   |
| 28.09    | 8.369   |
| 28.27999 | 8.442   |
| 28.28    | 8.443   |
| 28.29    | 8.666   |
| 28.49    | 9.362   |
| 28.49001 | 9.601   |
| 28.68999 | 10.348  |
| 28.69001 | 10.788  |
| 28.88999 | 10.989  |
| 28.89001 | 11.106  |
| 29.07999 | 11.266  |
| 29.09    | 11.615  |

Table 2.8-3 (continued). Percentage of time that 11.7 GHz isolation was less than the indicated value for July, 1977.

| ICTS     | PERCENT |
|----------|---------|
| 29.29    | 14.150  |
| 29.49    | 14.553  |
| 29.49001 | 14.569  |
| 29.68999 | 15.072  |
| 29.69001 | 15.083  |
| 29.88999 | 16.030  |
| 29.89001 | 16.976  |
| 30.08999 | 17.817  |
| 30.09    | 19.838  |
| 30.29    | 20.311  |
| 30.29999 | 20.344  |
| 30.49    | 20.892  |
| 30.49001 | 20.931  |
| 30.68999 | 22.089  |
| 30.69001 | 22.385  |
| 30.88999 | 23.114  |
| 30.89001 | 23.939  |
| 30.9     | 24.946  |
| 31.08999 | 25.095  |
| 31.09    | 25.180  |
| 31.1     | 25.323  |
| 31.29    | 25.762  |
| 31.49    | 26.408  |
| 31.49001 | 26.619  |
| 31.49999 | 26.867  |
| 31.68999 | 27.529  |
| 31.69001 | 28.524  |
| 31.7     | 28.857  |
| 31.88999 | 29.402  |
| 31.89001 | 29.952  |
| 31.9     | 30.950  |
| 32.08999 | 30.951  |
| 32.09    | 31.654  |
| 32.29    | 32.555  |
| 32.29999 | 32.848  |
| 32.49    | 33.871  |
| 32.49001 | 34.181  |
| 32.49999 | 34.427  |
| 32.50001 | 34.730  |
| 32.68999 | 35.649  |
| 32.69001 | 36.421  |
| 32.7     | 37.539  |
| 32.88999 | 37.956  |
| 32.89001 | 38.945  |
| 32.9     | 39.005  |
| 33.09    | 40.116  |
| 33.1     | 40.636  |
| 33.29    | 41.733  |
| 33.29999 | 41.870  |
| 33.30001 | 41.971  |
| 33.49    | 44.030  |
| 33.49001 | 44.699  |
| 33.49999 | 45.213  |
| 33.50001 | 45.250  |
| 33.68999 | 46.090  |

Table 2.8-3 (continued). Percentage of time that 11.7 GHz isolation was less than the indicated value for July, 1977.

Table 2.8-4. Regression equations for the month of July, 1977.

| Relationship                                                   | 11.7 GHz                                       |                |                | 19.04 GHz                                      |                |                | 28.56 GHz                   |                |                |
|----------------------------------------------------------------|------------------------------------------------|----------------|----------------|------------------------------------------------|----------------|----------------|-----------------------------|----------------|----------------|
|                                                                | Equation                                       | N <sub>s</sub> | R <sup>2</sup> | Equation                                       | N <sub>s</sub> | R <sup>2</sup> | Equation                    | N <sub>s</sub> | R <sup>2</sup> |
| I on log <sub>10</sub> (A)<br>for 3 < A < 30                   | I = 34.46 -<br>16.99*<br>log <sub>10</sub> (A) |                |                | I = 50.56 -<br>31.41*<br>log <sub>10</sub> (A) | 265            | .62            | [1]                         |                |                |
| A on R at equal<br>probability levels.                         | A = 3.37*<br>R.48                              | 9              | .86            | A = 3.34*<br>R.55                              |                |                | A = 3.51*<br>R.65           | 18             | .90            |
| Attenuation scaling.<br>A (11) at equal<br>probability levels. |                                                |                |                | A(11)=1.07*<br>A(19).86                        |                |                | A(11) = .71*<br>A(28).898   | 6              | .88            |
| Attenuation scaling.<br>A (19) at equal<br>probability levels. | A(19) = 1.32<br>*A(11) 1.04                    | 7              | .90            |                                                |                |                | A(19) = 1.42*<br>A(28) 1.05 | 11             | .99            |
| Attenuation scaling.<br>A (28) at equal<br>probability levels. | A(28) = 1.54<br>*A(11) 1.09                    | 6              | .98            | A(28) = .75<br>*A(19).94                       | 11             | .99            |                             |                |                |

[1] System malfunctioned during this month.

2.9 August, 1977

All data collected are valid. 11.7 GHz attenuation values for the last half of the month were scaled; a pedestal malfunction kept these from being recorded.

Table 2.9-1.

Key parameters for the month of August, 1977.

1. Rain Data

VPI&SU Accumulation, 56.61 mm

USWS Accumulation, 161.54 mm

Peak VPI&SU Rate, 121.73 mm/hr

Percent of monthly accumulation at

R > 10 mm/hr, 74.21%    R > 20 mm/hr, 64.46%    R > 50 mm/hr, 38.77%

R > 30 mm/hr, 54.18%    R > 40 mm/hr, 48.51%

2. Signal Data

| Channel | Monthly Mean<br>Co Signal, dBm | Maximum Fade,<br>dB | Minimum Isolation<br>While in Phaselock, dB |
|---------|--------------------------------|---------------------|---------------------------------------------|
| 11.7    | 80.18                          | 13.53               | 17.68                                       |
| 19.04V  | 85.74                          | 36.59               | 6.11                                        |
| 19.04H  | 86.87                          | 30.44               | -----                                       |
| 28.56   | 83.04                          | 73.18               | 11.91                                       |

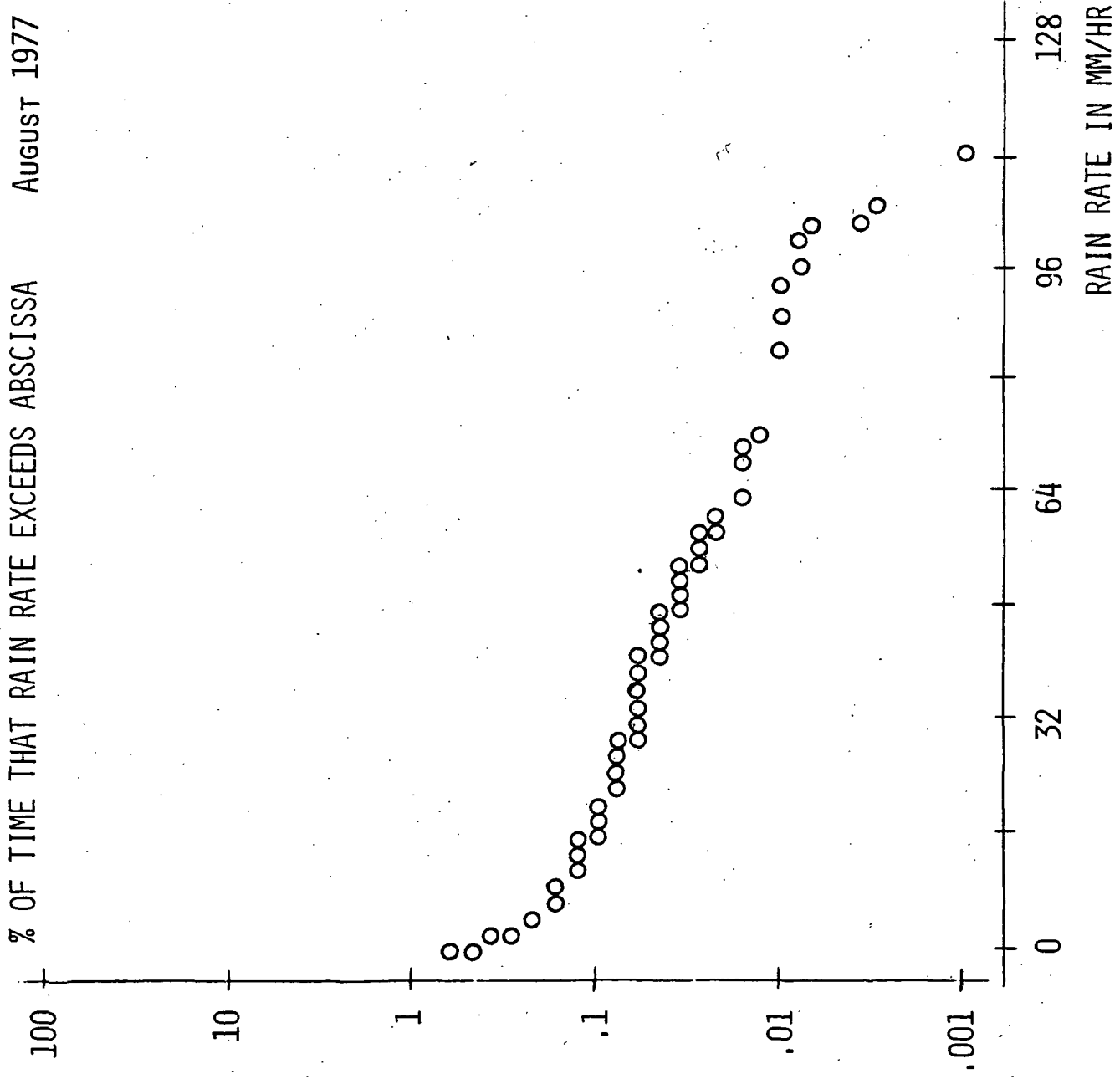


Figure 2.9-1. Rain rate statistics for August, 1977.



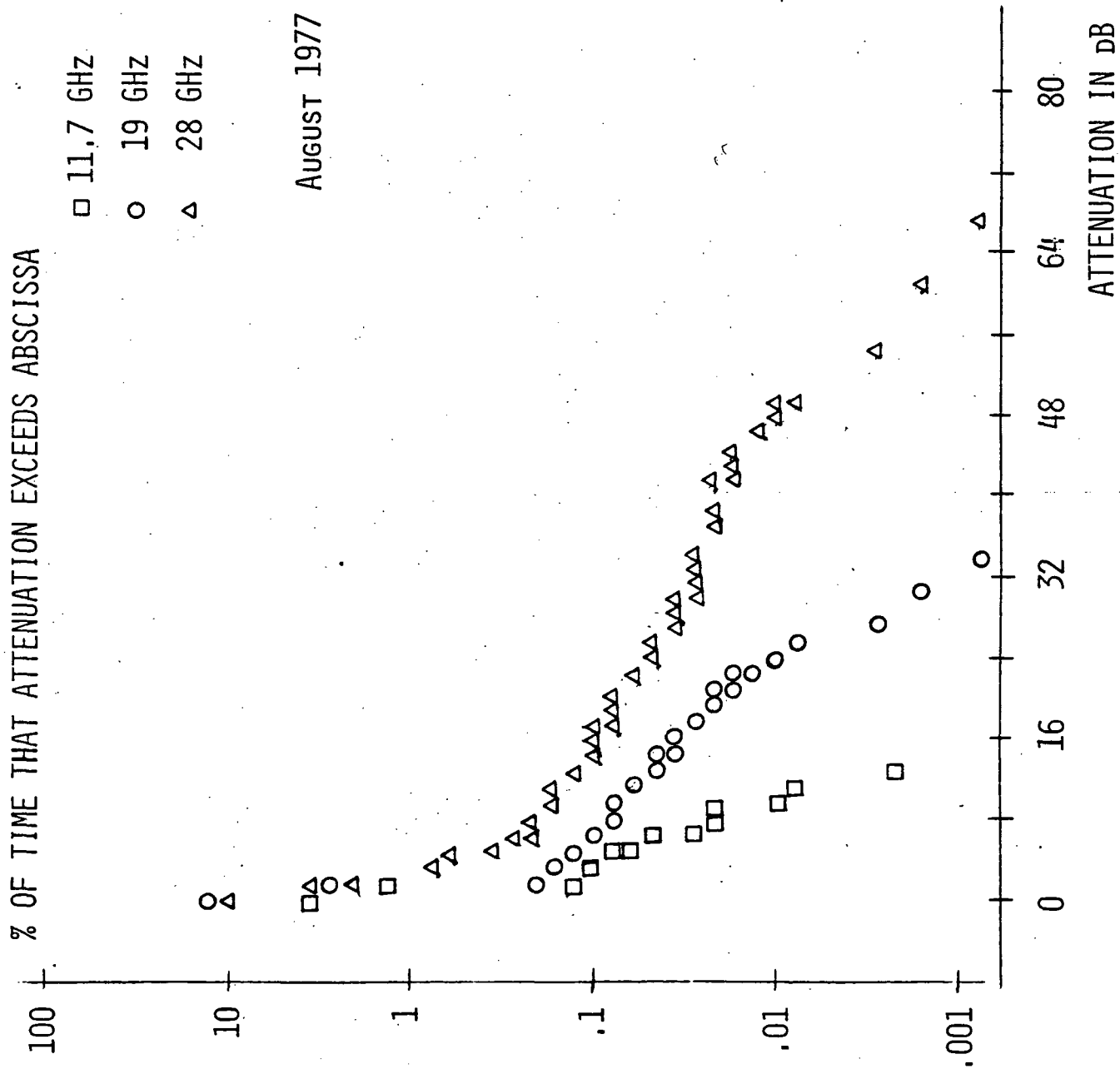


Figure 2.9-2. Attenuation statistics for August, 1977.

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| RAIN | ACTS | AV19 | AC28 | PER    |
|------|------|------|------|--------|
| .    | .    | 0    | .    | 17.511 |
| .    | .    | .    | 0    | 14.210 |
| .    | 0    | .    | .    | 4.566  |
| .    | .    | .    | 1    | 4.353  |
| .    | .    | 1    | .    | 3.181  |
| .    | .    | .    | 2    | 2.756  |
| .    | 1    | .    | .    | 1.636  |
| .    | .    | .    | 3    | 1.021  |
| .    | .    | .    | 4    | 0.691  |
| 0    | .    | .    | .    | 0.653  |
| 1    | .    | .    | 5    | 0.477  |
| 2    | .    | .    | .    | 0.457  |
| .    | .    | .    | .    | 0.388  |
| .    | .    | .    | 6    | 0.341  |
| 3    | .    | 2    | .    | 0.309  |
| .    | .    | .    | .    | 0.295  |
| .    | .    | .    | 7    | 0.281  |
| .    | .    | 3    | .    | 0.239  |
| 4    | .    | .    | 8    | 0.233  |
| .    | .    | .    | .    | 0.217  |
| 5    | .    | .    | 9    | 0.211  |
| 6    | .    | .    | .    | 0.206  |
| .    | .    | .    | 10   | 0.196  |
| 7    | .    | .    | .    | 0.189  |
| 8    | .    | 4    | 11   | 0.183  |
| .    | .    | .    | .    | 0.180  |
| 9    | 2    | .    | .    | 0.171  |
| .    | .    | .    | .    | 0.167  |
| 10   | .    | .    | 12   | 0.158  |
| .    | .    | .    | .    | 0.155  |
| 11   | .    | 5    | .    | 0.152  |
| 12   | .    | .    | .    | 0.148  |
| 13   | 3    | .    | 13   | 0.142  |
| .    | .    | .    | .    | 0.140  |
| 14   | .    | 6    | 14   | 0.134  |
| .    | .    | .    | .    | 0.129  |
| 15   | .    | .    | 15   | 0.125  |
| .    | .    | .    | .    | 0.122  |
| 16   | .    | .    | 16   | 0.120  |
| 17   | 4    | .    | 17   | 0.118  |
| .    | .    | .    | .    | 0.112  |
| 18   | .    | .    | .    | 0.111  |
| 19   | .    | 7    | .    | 0.110  |
| .    | .    | .    | .    | 0.106  |
| 20   | .    | .    | 18   | 0.105  |
| 21   | .    | 8    | .    | 0.103  |
| .    | .    | .    | .    | 0.102  |
| 22   | .    | .    | 19   | 0.099  |
| 23   | .    | .    | 20   | 0.095  |
| 24   | .    | 9    | .    | 0.092  |
| .    | .    | .    | .    | 0.090  |
| .    | .    | 10   | 21   | 0.085  |
| .    | .    | .    | .    | 0.084  |
| .    | 5    | .    | .    | 0.083  |

Table 2.9-2. Attenuation and rain rate  
percent-of-time data for  
August, 1977.

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| RAIN | ACTS | AV19 | AC28 | PER   |
|------|------|------|------|-------|
| .    | .    | .    | 22   | 0.080 |
| 25   | .    | .    | .    | 0.078 |
| 27   | .    | .    | .    | 0.076 |
| 28   | .    | 11   | .    | 0.072 |
| 29   | .    | .    | 23   | 0.069 |
| 30   | .    | .    | .    | 0.068 |
| 31   | 6    | .    | .    | 0.067 |
| 32   | .    | .    | .    | 0.065 |
| 34   | .    | 12   | .    | 0.063 |
| 35   | .    | .    | 24   | 0.062 |
| 36   | .    | .    | .    | 0.061 |
| 37   | .    | .    | .    | 0.059 |
| 39   | .    | .    | .    | 0.057 |
| .    | .    | .    | 25   | 0.056 |
| .    | .    | 13   | .    | 0.054 |
| 40   | .    | .    | 26   | 0.053 |
| 42   | .    | 14   | .    | 0.049 |
| 43   | .    | .    | .    | 0.048 |
| 44   | .    | 15   | 27   | 0.046 |
| .    | .    | .    | 28   | 0.045 |
| 46   | .    | .    | .    | 0.044 |
| 48   | .    | 16   | .    | 0.043 |
| .    | .    | .    | 29   | 0.041 |
| 49   | .    | .    | 30   | 0.040 |
| 51   | .    | 17   | 31   | 0.038 |
| 52   | .    | .    | 32   | 0.037 |
| 53   | .    | .    | .    | 0.036 |
| .    | 7    | .    | 33   | 0.035 |
| .    | .    | 18   | .    | 0.034 |
| 54   | .    | .    | 34   | 0.032 |
| 55   | 8    | .    | 36   | 0.031 |
| 56   | .    | .    | 38   | 0.030 |
| .    | .    | 19   | 39   | 0.029 |
| 58   | .    | .    | .    | 0.028 |
| 59   | 9    | 20   | 41   | 0.026 |
| 60   | .    | .    | 42   | 0.024 |
| .    | .    | 21   | 43   | 0.022 |
| .    | .    | 22   | 44   | 0.021 |
| 61   | .    | .    | .    | 0.020 |
| 62   | .    | .    | .    | 0.019 |
| 65   | .    | .    | .    | 0.018 |
| 69   | .    | .    | .    | 0.016 |
| 70   | .    | 23   | 47   | 0.015 |
| 72   | 10   | .    | 48   | 0.013 |
| 74   | .    | 24   | 49   | 0.012 |
| 85   | 11   | .    | .    | 0.011 |
| 88   | .    | .    | .    | 0.010 |
| 93   | .    | 25   | 50   | 0.009 |
| 97   | .    | .    | .    | 0.008 |
| 100  | .    | .    | .    | 0.007 |
| 102  | .    | .    | .    | 0.006 |
| 103  | .    | 27   | 54   | 0.004 |
| 106  | 12   | .    | 61   | 0.003 |
| .    | .    | 30   | .    | 0.002 |

Table 2.9-2 (continued). Attenuation and rain rate  
percent-of-time data for  
August, 1977.

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| RAIN | ACTS | AV19 | AC28 | PER   |
|------|------|------|------|-------|
| 112  | .    | 33   | 67   | 0.001 |
| 121  | 13   | 36   | 73   | 0.000 |

Table 2.9-2 (continued). Attenuation and rain rate  
percent-of-time data for  
August, 1977.

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| ICIS     | PERCENT |
|----------|---------|
| 17.68    | 0.002   |
| 18.27999 | 0.005   |
| 18.48    | 0.009   |
| 19.07999 | 0.012   |
| 19.88    | 0.019   |
| 20.68    | 0.031   |
| 21.07999 | 0.033   |
| 21.08001 | 0.036   |
| 21.09    | 0.038   |
| 21.27999 | 0.040   |
| 21.48    | 0.043   |
| 21.68    | 0.050   |
| 21.88    | 0.055   |
| 22.07999 | 0.062   |
| 22.27999 | 0.071   |
| 22.28    | 0.078   |
| 22.68    | 0.081   |
| 22.69001 | 0.083   |
| 23.07999 | 0.090   |
| 23.48    | 0.092   |
| 23.49    | 0.095   |
| 23.89001 | 0.104   |
| 24.08999 | 0.107   |
| 24.09    | 0.114   |
| 24.29    | 0.116   |
| 24.49    | 0.119   |
| 24.49001 | 0.121   |
| 24.88999 | 0.123   |
| 25.29    | 0.128   |
| 25.68999 | 0.130   |
| 25.89001 | 0.266   |
| 26.08999 | 0.270   |
| 26.49    | 0.277   |
| 26.69001 | 0.386   |
| 26.88    | 0.389   |
| 26.88999 | 0.567   |
| 26.89001 | 0.605   |
| 27.07999 | 0.915   |
| 27.09    | 1.129   |
| 27.29    | 1.449   |
| 27.48    | 1.661   |
| 27.49    | 2.072   |
| 27.49001 | 2.075   |
| 27.68    | 3.040   |
| 27.68999 | 3.760   |
| 27.69001 | 5.086   |
| 27.88999 | 6.942   |
| 27.89001 | 10.774  |
| 28.07999 | 11.630  |
| 28.08001 | 11.822  |
| 28.08999 | 13.392  |
| 28.09    | 15.912  |
| 28.28    | 16.173  |

Table 2.9-3. Percentage of time that 11.7 GHz isolation was less than the indicated value for August, 1977.

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| ICIS     | PERCENT |
|----------|---------|
| 28.29    | 18.795  |
| 28.48    | 21.350  |
| 28.49    | 21.844  |
| 28.49001 | 22.280  |
| 28.68999 | 26.425  |
| 28.69001 | 30.600  |
| 28.88    | 31.037  |
| 28.88001 | 31.909  |
| 28.88999 | 33.588  |
| 28.89001 | 33.898  |
| 29.07999 | 34.120  |
| 29.09    | 35.340  |
| 29.27999 | 36.587  |
| 29.28    | 37.121  |
| 29.29    | 37.981  |
| 29.48    | 38.110  |
| 29.49    | 39.290  |
| 29.49001 | 39.360  |
| 29.68    | 39.598  |
| 29.68999 | 41.671  |
| 29.69001 | 41.995  |
| 29.88999 | 42.707  |
| 29.89001 | 45.265  |
| 30.08999 | 45.301  |
| 30.09    | 47.003  |
| 30.29    | 47.781  |
| 30.29999 | 48.184  |
| 30.49    | 48.973  |
| 30.49001 | 49.557  |
| 30.49999 | 52.767  |
| 30.68999 | 56.051  |
| 30.69001 | 56.112  |
| 30.69999 | 56.425  |
| 30.7     | 57.445  |
| 30.88999 | 62.476  |
| 30.89001 | 63.439  |
| 30.9     | 63.482  |
| 31.09    | 63.821  |
| 31.1     | 65.044  |
| 31.29    | 67.635  |
| 31.29999 | 68.965  |
| 31.30001 | 68.908  |
| 31.49    | 69.231  |
| 31.49001 | 69.279  |
| 31.49999 | 69.757  |
| 31.50001 | 70.168  |
| 31.68999 | 71.164  |
| 31.69001 | 71.903  |
| 31.69999 | 71.970  |
| 31.7     | 71.975  |
| 31.89001 | 72.942  |
| 31.9     | 74.587  |
| 32.08999 | 74.590  |
| 32.09    | 75.202  |
| 32.1     | 75.209  |

Table 2.9-3 (continued). Percentage of time that 11.7 GHz isolation was less than the indicated value for August, 1977.

| ICTS     | PERCENT |
|----------|---------|
| 32.29    | 75.010  |
| 32.29999 | 76.638  |
| 32.30001 | 76.771  |
| 32.49    | 76.992  |
| 32.49001 | 77.878  |
| 32.49999 | 77.886  |
| 32.69001 | 78.187  |
| 32.7     | 79.498  |
| 32.88999 | 79.633  |
| 32.89001 | 79.944  |
| 33.09    | 80.321  |
| 33.1     | 80.650  |
| 33.29    | 82.049  |
| 33.49    | 82.267  |
| 33.49001 | 82.305  |
| 33.49999 | 82.575  |
| 33.68999 | 82.848  |
| 33.89001 | 83.351  |
| 33.9     | 83.872  |
| 34.08999 | 83.875  |
| 34.09    | 85.610  |
| 34.29    | 85.985  |
| 34.49    | 86.061  |
| 34.68999 | 86.099  |
| 34.69001 | 86.601  |
| 34.88999 | 86.608  |
| 34.89001 | 86.945  |
| 34.9     | 86.945  |
| 35.09    | 86.956  |
| 35.29    | 87.346  |
| 35.49    | 88.143  |
| 35.49001 | 88.290  |
| 35.68999 | 88.506  |
| 35.69001 | 88.752  |
| 36.08999 | 88.754  |
| 36.09    | 89.013  |
| 36.29    | 89.738  |
| 36.49    | 89.752  |
| 36.49001 | 90.120  |
| 36.68999 | 90.156  |
| 36.69001 | 90.375  |
| 36.88999 | 90.378  |
| 36.89001 | 90.661  |
| 37.09    | 91.004  |
| 37.29    | 91.287  |
| 37.30001 | 91.305  |
| 37.49    | 92.097  |
| 37.49001 | 92.195  |
| 37.69001 | 92.382  |
| 37.89001 | 92.726  |
| 38.09    | 92.842  |
| 38.1     | 92.956  |
| 38.29    | 94.065  |
| 38.30001 | 94.426  |
| 38.50001 | 94.468  |

Table 2.9-3 (continued). Percentage of time that 11.7 GHz isolation was less than the indicated value for August, 1977.

Table 2.9-4. Regression Equations for the month of August, 1977.

| Relationship                                                   | 11.7 GHz                                   |                |                | 19.04 GHz                                  |                |                | 28.56 GHz                                      |                |                |
|----------------------------------------------------------------|--------------------------------------------|----------------|----------------|--------------------------------------------|----------------|----------------|------------------------------------------------|----------------|----------------|
|                                                                | Equation                                   | N <sub>s</sub> | R <sup>2</sup> | Equation                                   | N <sub>s</sub> | R <sup>2</sup> | Equation                                       | N <sub>s</sub> | R <sup>2</sup> |
| I on log <sub>10</sub> (A)<br>for 3 < A < 30                   | I = 44.63 -<br>22.44 log <sub>10</sub> (A) | 131            | .76            | I = 43.91 -<br>19.84 log <sub>10</sub> (A) | 181            | .71            | I = 39.55 -<br>14.96*<br>log <sub>10</sub> (A) | 2169           | .24            |
| A on R at equal<br>probability levels.                         | A = .78*<br>R <sup>.59</sup>               | 7              | .99            | A = .92*<br>R <sup>.75</sup>               | 15             | .99            | A = 2.39*<br>R <sup>.68</sup>                  | 22             | .95            |
| Attenuation scaling.<br>A (11) at equal<br>probability levels. |                                            |                |                | ID                                         |                |                | A(11) = .33*<br>A(28) <sup>.87</sup>           | 5              | .99            |
| Attenuation scaling.<br>A (19) at equal<br>probability levels. | ID                                         |                |                |                                            |                |                | A(19) = .33*<br>A(28) <sup>1.11</sup>          | 15             | .98            |
| Attenuation scaling.<br>A (28) at equal<br>probability levels. | A(28) = 3.61<br>*A(11) <sup>1.13</sup>     | 5              | .99            | A(28) = 2.85<br>*A(19) <sup>.88</sup>      | 15             | .98            |                                                |                |                |

ID insufficient data



2.10 September, 1977

11.7 GHz attenuation data may have been influenced slightly by daily spacecraft shutdowns for eclipse. Where possible these were ignored in the statistical calculations. For the same reason the 11.7 GHz isolation data are questionable.

Table 2.10-1.

Key parameters for the month of September, 1977.

1. Rain Data

VPI&SU Accumulation, 46.61 mm

USWS Accumulation, 104.90 mm

Peak VPI&SU Rate, 60.80 mm/hr

Percent of monthly accumulation at

R > 10 mm/hr, 32.20%      R > 20 mm/hr, 25.58%      R > 50 mm/hr, 6.75%

R > 30 mm/hr, 19.97%      R > 40 mm/hr, 12.39%

2. Signal Data

| Channel | Monthly Mean<br>Co Signal, dBm | Maximum Fade,<br>dB | Minimum Isolation<br>While in Phaselock, dB |
|---------|--------------------------------|---------------------|---------------------------------------------|
| 11.7    | -81.63                         | 15.38               | 14.48                                       |
| 19.04V  | -85.42                         | 25.41               | 22.52                                       |
| 19.04H  | -87.01                         | 24.59               | -----                                       |
| 28.56   | -81.51                         | 50.81               | 15.51                                       |

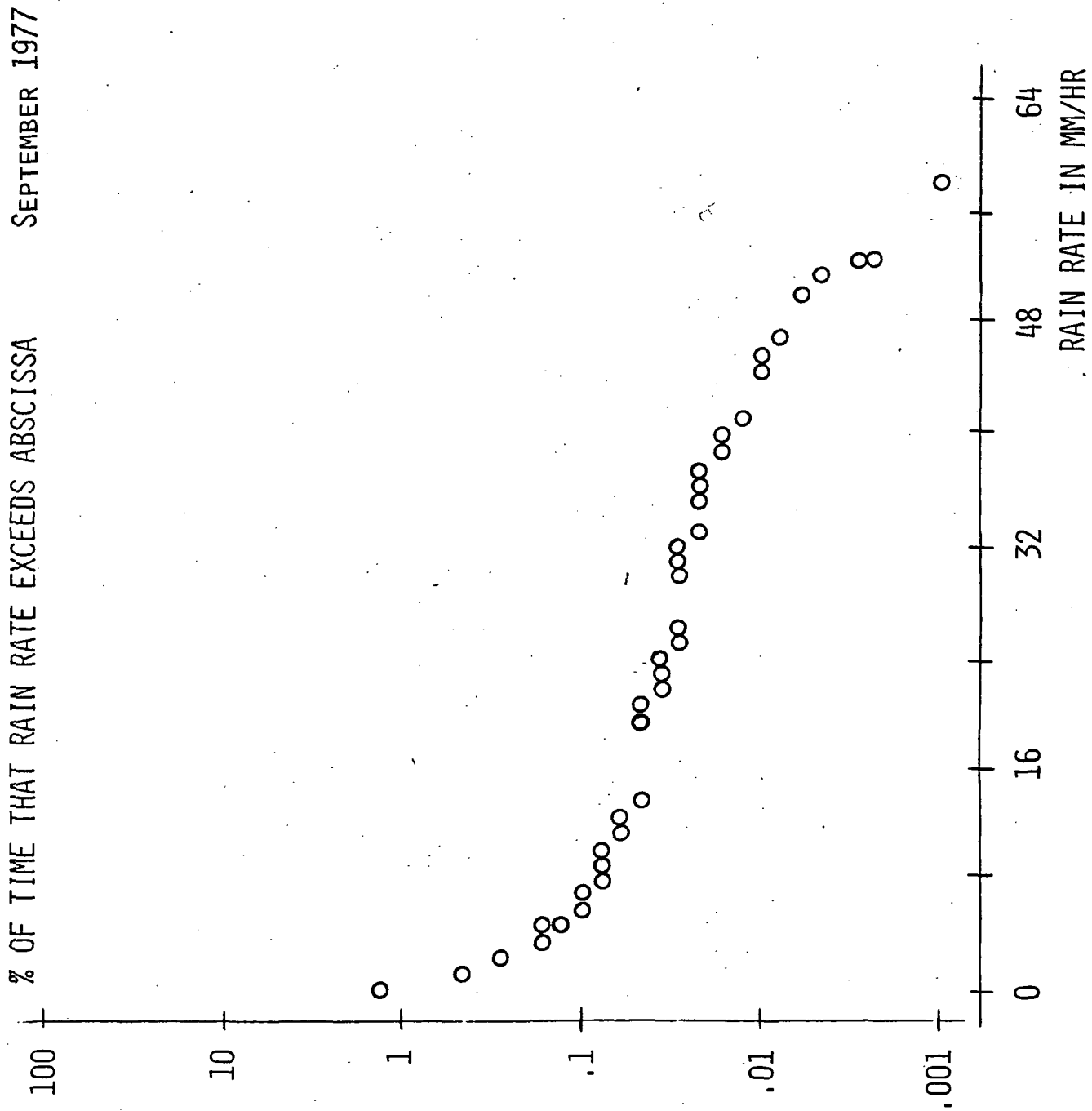


Figure 2.10-1. Rain rate statistics for September, 1977.

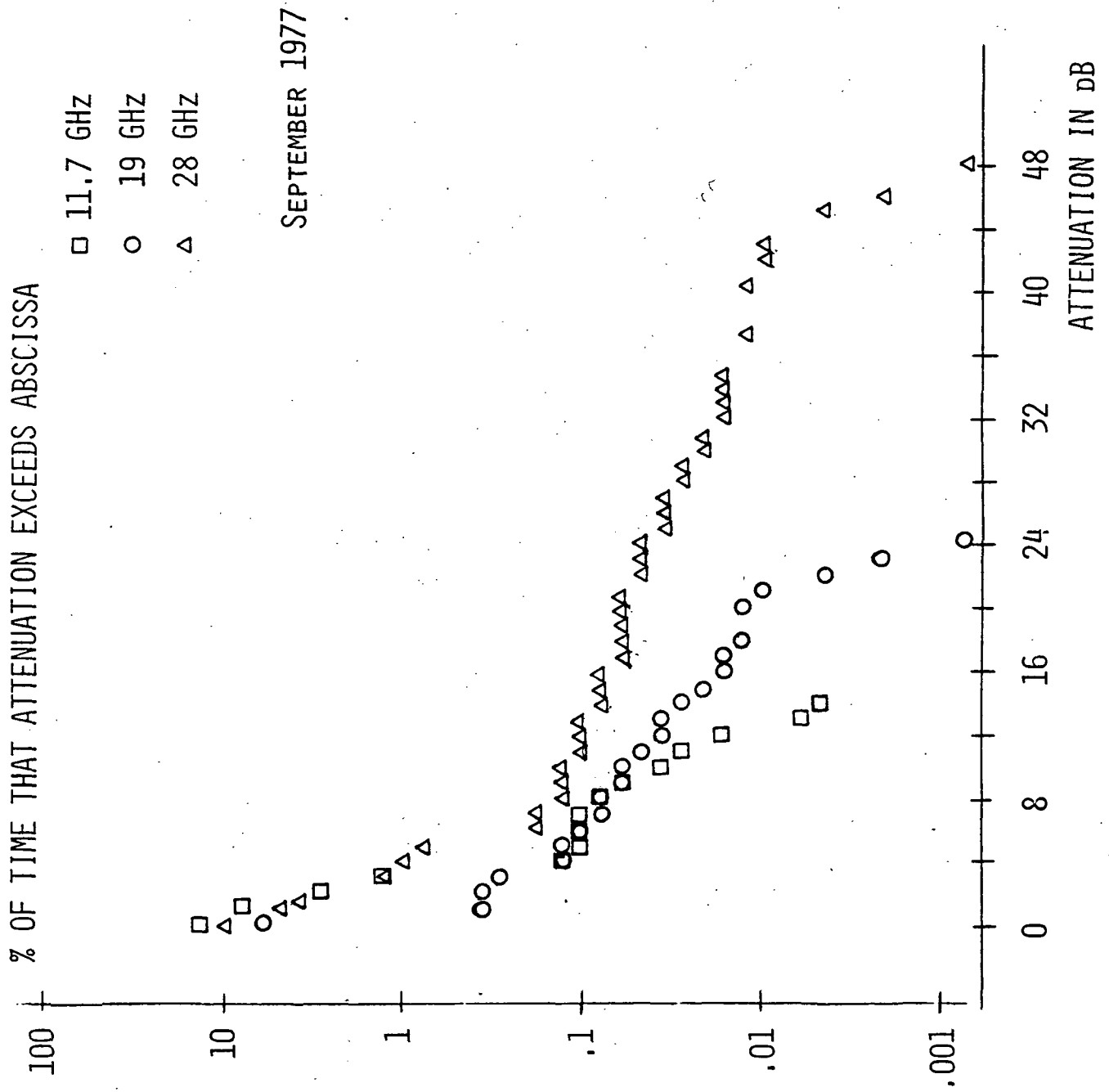


Figure 2.10-2. Attenuation statistics for September, 1977.

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| RAIN | ACTS | AV19 | AC28 | PER    |
|------|------|------|------|--------|
| .    | 0    | .    | .    | 18.049 |
| .    | .    | .    | 0    | 13.563 |
| .    | 1    | .    | .    | 10.202 |
| .    | .    | 0    | .    | 8.103  |
| .    | .    | .    | 1    | 5.608  |
| .    | .    | .    | 2    | 4.824  |
| .    | 2    | .    | .    | 3.451  |
| .    | .    | .    | 3    | 2.743  |
| .    | 3    | .    | .    | 1.550  |
| 0    | .    | .    | .    | 1.365  |
| .    | .    | .    | 4    | 1.268  |
| .    | .    | .    | 5    | 0.886  |
| 1    | .    | .    | .    | 0.507  |
| .    | .    | 1    | .    | 0.506  |
| .    | .    | 2    | .    | 0.407  |
| .    | .    | .    | 6    | 0.359  |
| 2    | .    | 3    | .    | 0.318  |
| .    | .    | .    | .    | 0.259  |
| 3    | .    | 4    | .    | 0.179  |
| .    | 4    | .    | .    | 0.174  |
| .    | .    | .    | .    | 0.168  |
| 4    | .    | .    | .    | 0.159  |
| .    | .    | .    | 7    | 0.152  |
| .    | .    | 5    | .    | 0.149  |
| .    | .    | .    | 8    | 0.141  |
| .    | 5    | .    | .    | 0.133  |
| .    | .    | .    | 9    | 0.132  |
| .    | .    | 6    | .    | 0.131  |
| .    | 6    | .    | .    | 0.126  |
| 5    | .    | .    | .    | 0.125  |
| .    | 7    | .    | .    | 0.124  |
| .    | .    | .    | 10   | 0.116  |
| .    | 8    | .    | .    | 0.112  |
| .    | .    | 7    | .    | 0.110  |
| .    | .    | .    | 11   | 0.105  |
| 6    | .    | .    | .    | 0.104  |
| .    | .    | .    | 12   | 0.098  |
| .    | .    | 8    | .    | 0.095  |
| .    | .    | .    | 13   | 0.091  |
| 7    | .    | .    | .    | 0.090  |
| .    | .    | .    | 14   | 0.088  |
| 8    | .    | .    | .    | 0.081  |
| .    | .    | .    | 15   | 0.080  |
| 9    | .    | .    | .    | 0.078  |
| .    | .    | .    | 16   | 0.075  |
| 10   | .    | 9    | .    | 0.074  |
| .    | 9    | .    | .    | 0.073  |
| .    | .    | 10   | .    | 0.071  |
| .    | .    | .    | 17   | 0.067  |
| 11   | .    | .    | .    | 0.064  |
| 12   | .    | .    | .    | 0.061  |
| .    | .    | .    | 18   | 0.060  |
| .    | .    | .    | 19   | 0.059  |
| 13   | .    | .    | 20   | 0.056  |

Table 2.10-2. Attenuation and rain rate percent-of-time data for September, 1977.

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| RAIN | ACTS | AV19 | AC28 | PER   |
|------|------|------|------|-------|
| .    | .    | 11   | .    | 0.054 |
| .    | .    | .    | 21   | 0.052 |
| 14   | .    | .    | .    | 0.051 |
| .    | .    | 12   | 22   | 0.050 |
| 19   | .    | .    | .    | 0.046 |
| 20   | .    | .    | .    | 0.045 |
| .    | 10   | .    | 23   | 0.044 |
| .    | .    | 13   | 24   | 0.043 |
| 21   | .    | .    | .    | 0.042 |
| .    | .    | .    | 25   | 0.038 |
| 22   | 11   | .    | 26   | 0.035 |
| 23   | .    | .    | 27   | 0.034 |
| 24   | .    | 14   | .    | 0.032 |
| 25   | .    | .    | .    | 0.031 |
| 26   | .    | .    | 28   | 0.030 |
| 30   | .    | .    | .    | 0.029 |
| 31   | .    | .    | .    | 0.027 |
| 32   | .    | 15   | 29   | 0.025 |
| 33   | .    | .    | 30   | 0.024 |
| 35   | .    | .    | 31   | 0.023 |
| 36   | 12   | 16   | .    | 0.022 |
| .    | .    | .    | 32   | 0.021 |
| 37   | .    | 17   | .    | 0.020 |
| 38   | .    | .    | 35   | 0.019 |
| .    | .    | 18   | 37   | 0.017 |
| 39   | .    | 20   | 40   | 0.016 |
| 40   | .    | .    | .    | 0.015 |
| .    | .    | .    | 42   | 0.014 |
| .    | .    | 21   | 43   | 0.012 |
| 45   | .    | .    | .    | 0.010 |
| 46   | .    | .    | .    | 0.009 |
| 47   | 13   | .    | .    | 0.008 |
| 50   | 14   | 22   | 45   | 0.006 |
| 51   | .    | .    | .    | 0.005 |
| 52   | .    | .    | .    | 0.003 |
| 53   | .    | 23   | 47   | 0.002 |
| 58   | .    | 24   | 48   | 0.001 |
| 60   | 15   | 25   | 50   | 0.000 |

Table 2.10-2 (continued). Attenuation and rain rate percent-of-time data for September, 1977.

| ICIS     | PERCENT |
|----------|---------|
| 14.47999 | 0.001   |
| 15.27999 | 0.009   |
| 15.88    | 0.013   |
| 16.68    | 0.016   |
| 17.27999 | 0.020   |
| 17.28    | 0.021   |
| 18.07999 | 0.030   |
| 18.08001 | 0.035   |
| 18.68    | 0.248   |
| 18.88    | 0.314   |
| 19.28    | 0.317   |
| 19.47999 | 0.444   |
| 19.48    | 0.592   |
| 19.68    | 0.886   |
| 19.88001 | 1.147   |
| 20.57999 | 1.191   |
| 20.27999 | 1.192   |
| 20.28    | 1.453   |
| 20.48    | 1.690   |
| 20.68    | 2.037   |
| 20.88    | 2.076   |
| 20.89001 | 2.077   |
| 21.07999 | 2.140   |
| 21.28    | 2.168   |
| 21.47999 | 2.306   |
| 21.48    | 2.325   |
| 21.68    | 2.552   |
| 21.68999 | 2.554   |
| 21.88    | 2.630   |
| 21.88001 | 2.777   |
| 22.08001 | 2.789   |
| 22.27999 | 2.935   |
| 22.28    | 2.941   |
| 22.47999 | 3.067   |
| 22.48    | 3.114   |
| 22.49    | 3.117   |
| 22.68    | 3.302   |
| 22.88    | 3.370   |
| 23.07999 | 3.509   |
| 23.28    | 3.717   |
| 23.47999 | 3.743   |
| 23.68    | 3.918   |
| 23.88001 | 3.940   |
| 24.07999 | 3.958   |
| 24.08001 | 3.989   |
| 24.09    | 3.991   |
| 24.27999 | 3.999   |
| 24.28    | 4.000   |
| 24.48    | 4.174   |
| 24.68    | 4.188   |
| 24.88    | 4.197   |
| 24.88001 | 4.270   |
| 25.08001 | 4.289   |

Table 2.10-3. Percentage of time that 11.7 GHz isolation was less than the indicated value for September, 1977.

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| ICTS     | PERCENT |
|----------|---------|
| 25.28    | 4.354   |
| 25.29    | 4.355   |
| 25.48    | 4.357   |
| 25.49    | 4.358   |
| 25.68    | 4.716   |
| 25.68999 | 4.745   |
| 25.88    | 4.851   |
| 25.88999 | 4.868   |
| 26.08001 | 4.916   |
| 26.08999 | 4.996   |
| 26.09    | 5.003   |
| 26.27999 | 5.101   |
| 26.28    | 7.896   |
| 26.29    | 7.897   |
| 26.48    | 8.074   |
| 26.49    | 8.044   |
| 26.68    | 20.825  |
| 26.68999 | 20.842  |
| 26.88001 | 20.996  |
| 26.88999 | 21.324  |
| 26.89001 | 21.391  |
| 27.07999 | 21.653  |
| 27.08001 | 21.773  |
| 27.27999 | 32.879  |
| 27.28    | 33.468  |
| 27.29    | 34.815  |
| 27.48    | 35.127  |
| 27.49    | 35.457  |
| 27.49001 | 35.462  |
| 27.68    | 36.058  |
| 27.68999 | 36.506  |
| 27.88    | 36.657  |
| 27.88001 | 36.967  |
| 27.88999 | 37.013  |
| 28.07999 | 38.083  |
| 28.09    | 38.578  |
| 28.27999 | 39.400  |
| 28.28    | 39.462  |
| 28.29    | 40.346  |
| 28.48    | 41.577  |
| 28.49    | 42.048  |
| 28.49001 | 42.435  |
| 28.68    | 43.284  |
| 28.68999 | 43.385  |
| 28.88    | 44.093  |
| 28.88999 | 44.655  |
| 28.89001 | 44.749  |
| 29.07999 | 45.995  |
| 29.08999 | 46.402  |
| 29.09    | 46.833  |
| 29.28    | 46.855  |
| 29.29    | 48.174  |
| 29.48    | 48.385  |
| 29.49    | 49.767  |
| 29.49001 | 49.768  |

Table 2.10-3 (continued). Percentage of time that 11.7 GHz isolation was less than the indicated value for September, 1977.



| ICIS     | PERCENT |
|----------|---------|
| 29.68999 | 50.587  |
| 29.69001 | 50.647  |
| 29.88999 | 51.897  |
| 29.89001 | 52.642  |
| 30.08999 | 52.684  |
| 30.09    | 53.414  |
| 30.29    | 54.102  |
| 30.49    | 54.352  |
| 30.49001 | 54.472  |
| 30.49999 | 54.572  |
| 30.68999 | 55.481  |
| 30.69001 | 55.622  |
| 30.69999 | 55.681  |
| 30.88999 | 55.775  |
| 30.89001 | 56.527  |
| 31.09    | 57.275  |
| 31.29    | 57.798  |
| 31.29999 | 57.883  |
| 31.49    | 58.252  |
| 31.49001 | 58.324  |
| 31.49999 | 58.690  |
| 31.68999 | 58.817  |
| 31.69001 | 59.383  |
| 31.88999 | 59.591  |
| 31.89001 | 60.058  |
| 32.08999 | 60.098  |
| 32.09    | 60.517  |
| 32.1     | 60.640  |
| 32.29    | 61.568  |
| 32.29999 | 61.712  |
| 32.49    | 62.450  |
| 32.49001 | 62.909  |
| 32.49999 | 62.911  |
| 32.68999 | 63.659  |
| 32.69001 | 64.089  |
| 32.7     | 64.236  |
| 32.88999 | 64.442  |
| 32.89001 | 64.692  |
| 32.9     | 64.724  |
| 33.08999 | 64.725  |
| 33.09    | 65.489  |
| 33.1     | 65.825  |
| 33.29    | 67.485  |
| 33.29999 | 67.486  |
| 33.30001 | 67.487  |
| 33.49    | 68.489  |
| 33.49001 | 68.859  |
| 33.50001 | 68.951  |
| 33.68999 | 69.415  |
| 33.69001 | 69.983  |
| 33.7     | 70.036  |
| 33.88999 | 70.102  |
| 33.89001 | 70.310  |
| 33.9     | 70.549  |
| 34.09    | 72.008  |

Table 2.10-3 (continued). Percentage of time that 11.7 GHz isolation was less than the indicated value for September, 1977.

Table 2.10-4. Regression equations for the month of September, 1977.

| Relationship                                                   | 11.7 GHz                              |                |                | 19.04 GHz                                      |                |                | 28.56 GHz                                   |                |                |
|----------------------------------------------------------------|---------------------------------------|----------------|----------------|------------------------------------------------|----------------|----------------|---------------------------------------------|----------------|----------------|
|                                                                | Equation                              | N <sub>s</sub> | R <sup>2</sup> | Equation                                       | N <sub>s</sub> | R <sup>2</sup> | Equation                                    | N <sub>s</sub> | R <sup>2</sup> |
| I on log <sub>10</sub> (A)<br>for 3 < A < 30                   | [1]                                   |                |                | I = 17.03 +<br>22.84*<br>log <sub>10</sub> (A) | 12             | .23            | I = 34.19<br>13.07<br>log <sub>10</sub> (A) | 4120           | .54            |
| A on R at equal<br>probability levels.                         | A = 4.22*<br>R <sup>.30</sup>         | 4              | .92            | A = 2.25*<br>R <sup>.58</sup>                  | 9              | .96            | A = 3.69*<br>R <sup>.63</sup>               | 12             | .94            |
| Attenuation scaling.<br>A (11) at equal<br>probability levels. |                                       |                |                | A(11) = 3.02*<br>A(19) <sup>.50</sup>          | 2              | .99            | A = 2.15*<br>A(28) <sup>.50</sup>           | 2              | .99            |
| Attenuation scaling.<br>A (19) at equal<br>probability levels. | A(19) = .11*<br>A(11) <sup>2.01</sup> | 2              | .99            |                                                |                |                | A(19) = .80*<br>A(28) <sup>.87</sup>        | 9              | .99            |
| Attenuation scaling.<br>A (28) at equal<br>probability levels. | A(28) = .22<br>A(11) <sup>2.01</sup>  | 3              | .99            | A(28) = 1.32*<br>A(19) <sup>1.14</sup>         | 9              | .99            |                                             |                |                |

[1] Data invalidated by intermittent spacecraft operation during eclipse period.

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2.11 October, 1977

All attenuation data are valid.

Table 2.11-1.

Key parameters for the month of October, 1977.

1. Rain Data

VPI&SU Accumulation, 59.77 mm

USWS Accumulation, 159.77 mm

Peak VPI&SU Rate, 79.45 mm/hr

Percent of monthly accumulation at

|                      |                      |                     |
|----------------------|----------------------|---------------------|
| R > 10 mm/hr, 33.73% | R > 20 mm/hr, 21.74% | R > 50 mm/hr, 7.53% |
| R > 30 mm/hr, 15.00% | R > 40 mm/hr, 12.04% |                     |

2. Signal Data

| Channel | Monthly Mean<br>Co Signal, dBm | Maximum Fade,<br>dB | Minimum Isolation<br>While in Phaselock, dB |
|---------|--------------------------------|---------------------|---------------------------------------------|
| 11.7    | -81.90                         | 27.08               | 19.88                                       |
| 19.04V  | -87.71                         | 28.08               | 7.91                                        |
| 19.04H  | -88.57                         | -----               | -----                                       |
| 28.56   | -85.24                         | 36.16               | 17.72                                       |

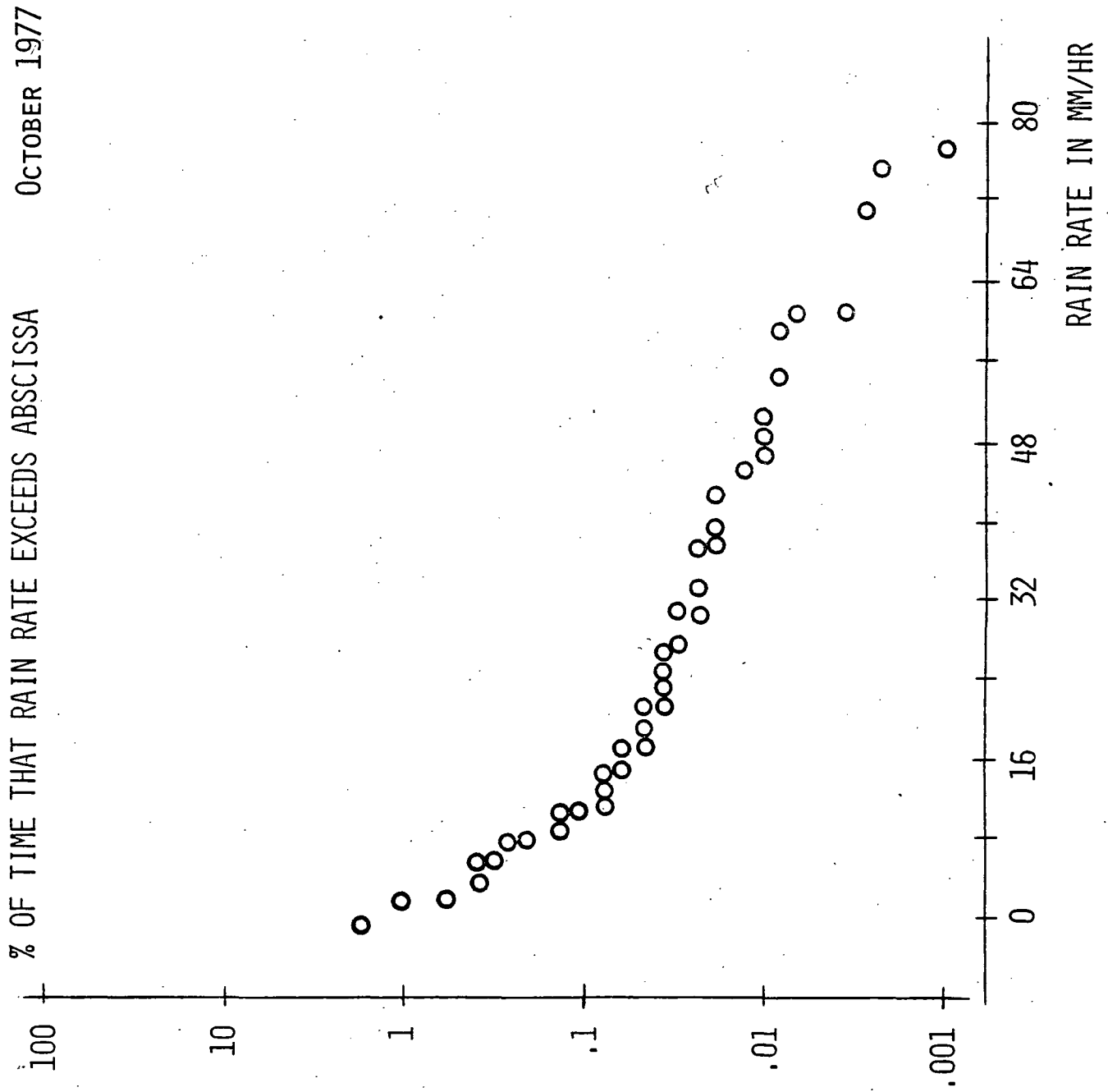


Figure 2.11-1. Rain rate statistics for October, 1977.

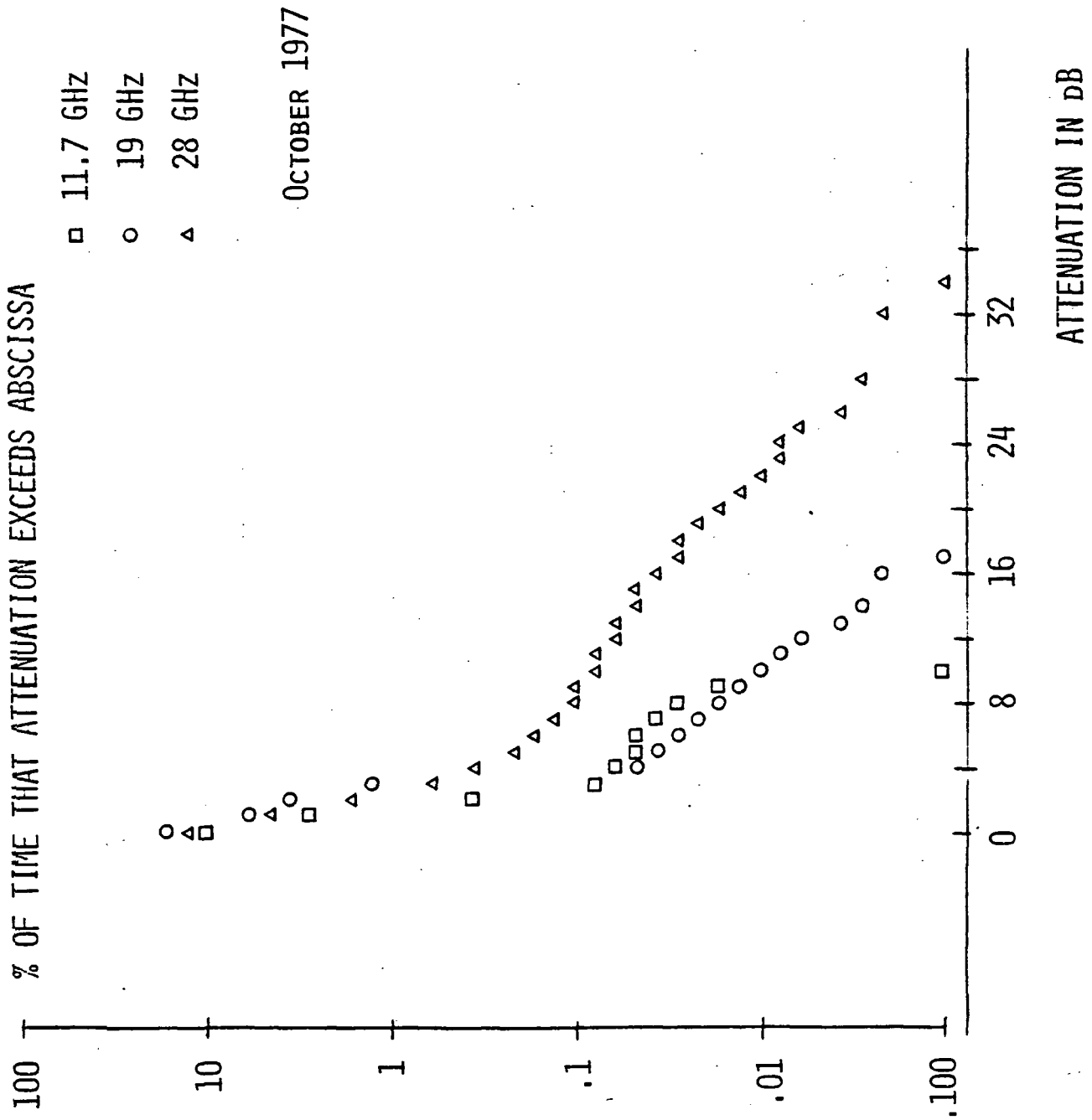


Figure 2.11-2. Attenuation statistics for October, 1977.

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| RAIN | ACTS | AV19 | AC28 | PER    |
|------|------|------|------|--------|
| .    | .    | 0    | .    | 16.529 |
| .    | .    | .    | 0    | 14.354 |
| .    | 0    | .    | .    | 9.259  |
| .    | .    | 1    | .    | 6.001  |
| .    | .    | .    | 1    | 5.106  |
| .    | 1    | 2    | .    | 3.824  |
| .    | .    | .    | .    | 2.449  |
| .    | .    | .    | 2    | 1.863  |
| 0    | .    | .    | .    | 1.505  |
| .    | .    | 3    | .    | 1.227  |
| 1    | .    | .    | .    | 0.975  |
| .    | .    | .    | 3    | 0.677  |
| 2    | .    | .    | .    | 0.542  |
| .    | 2    | .    | .    | 0.386  |
| 3    | .    | .    | .    | 0.379  |
| .    | .    | .    | 4    | 0.349  |
| 4    | .    | .    | .    | 0.333  |
| .    | .    | .    | .    | 0.274  |
| 5    | .    | .    | 5    | 0.225  |
| .    | .    | .    | .    | 0.195  |
| 6    | .    | .    | 6    | 0.181  |
| .    | .    | .    | .    | 0.168  |
| 7    | .    | .    | 7    | 0.130  |
| .    | .    | .    | .    | 0.128  |
| 8    | .    | .    | .    | 0.114  |
| .    | .    | .    | 8    | 0.103  |
| 10   | .    | .    | .    | 0.097  |
| .    | .    | .    | 9    | 0.091  |
| .    | 3    | .    | .    | 0.085  |
| 11   | .    | .    | .    | 0.083  |
| .    | .    | .    | .    | 0.081  |
| 12   | .    | .    | 10   | 0.080  |
| .    | .    | .    | .    | 0.078  |
| 13   | .    | .    | .    | 0.076  |
| 14   | .    | .    | 11   | 0.073  |
| .    | .    | .    | .    | 0.067  |
| 15   | .    | .    | 12   | 0.062  |
| .    | 4    | .    | .    | 0.057  |
| .    | .    | .    | .    | 0.054  |
| 16   | .    | .    | 13   | 0.053  |
| .    | .    | .    | .    | 0.047  |
| 18   | .    | .    | .    | 0.045  |
| 19   | .    | .    | .    | 0.044  |
| 20   | .    | .    | .    | 0.043  |
| .    | 5    | .    | 14   | 0.041  |
| .    | 6    | 4    | 15   | 0.040  |
| 21   | .    | .    | .    | 0.038  |
| 23   | .    | .    | .    | 0.036  |
| 24   | 7    | .    | .    | 0.035  |
| .    | .    | .    | 16   | 0.032  |
| 25   | .    | 5    | .    | 0.030  |
| 26   | .    | .    | .    | 0.029  |
| .    | 8    | .    | .    | 0.028  |
| .    | .    | .    | 17   | 0.027  |
| 28   | .    | .    | .    |        |

Table 2.11-2. Attenuation and rain rate  
percent-of-time data for  
October, 1977.

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| RAIN | ACTS | AV19 | AC28 | PER   |
|------|------|------|------|-------|
| .    | .    | .    | 18   | 0.026 |
| .    | .    | 6    | .    | 0.025 |
| 29   | .    | .    | .    | 0.024 |
| 30   | .    | 7    | .    | 0.022 |
| 31   | .    | .    | .    | 0.021 |
| 36   | .    | .    | 19   | 0.019 |
| 37   | .    | 8    | .    | 0.018 |
| 39   | .    | .    | .    | 0.017 |
| .    | .    | .    | 20   | 0.016 |
| 42   | 9    | .    | .    | 0.015 |
| 45   | .    | 9    | .    | 0.013 |
| .    | .    | .    | 21   | 0.012 |
| 47   | .    | .    | .    | 0.011 |
| 48   | .    | 10   | .    | 0.010 |
| 49   | .    | .    | 22   | 0.009 |
| 55   | .    | .    | 23   | 0.008 |
| 59   | .    | 11   | 24   | 0.007 |
| 60   | .    | 12   | 25   | 0.006 |
| 61   | .    | 13   | 26   | 0.004 |
| 71   | .    | 14   | 28   | 0.003 |
| 75   | .    | 16   | 32   | 0.002 |
| 77   | 10   | 17   | 34   | 0.001 |
| 79   | 27   | 18   | 36   | 0.000 |

Table 2.11-2 (continued). Attenuation and rain rate  
percent-of-time data for  
October, 1977.



| ICTS     | PERCENT |
|----------|---------|
| 19.88    | 0.002   |
| 21.48    | 0.004   |
| 22.09    | 0.006   |
| 22.27999 | 0.008   |
| 23.29    | 0.010   |
| 23.89001 | 0.012   |
| 24.49    | 0.014   |
| 24.68999 | 0.016   |
| 25.29    | 0.018   |
| 26.09    | 0.024   |
| 26.27999 | 0.037   |
| 26.29    | 0.039   |
| 26.47999 | 0.303   |
| 26.49    | 0.309   |
| 26.49001 | 0.425   |
| 26.88999 | 0.433   |
| 26.89001 | 0.449   |
| 27.08999 | 0.512   |
| 27.09    | 0.518   |
| 27.27999 | 0.520   |
| 27.29    | 1.022   |
| 27.49001 | 1.024   |
| 27.68999 | 1.109   |
| 27.69001 | 1.243   |
| 27.88999 | 1.253   |
| 27.89001 | 1.274   |
| 28.08001 | 1.278   |
| 28.08999 | 1.456   |
| 28.09    | 1.463   |
| 28.28    | 1.672   |
| 28.29    | 1.674   |
| 28.48    | 2.017   |
| 28.49    | 2.468   |
| 28.49001 | 2.488   |
| 28.68999 | 2.535   |
| 28.69001 | 2.543   |
| 28.88    | 2.560   |
| 28.88999 | 2.943   |
| 28.89001 | 2.950   |
| 29.08999 | 2.952   |
| 29.09    | 2.976   |
| 29.29    | 3.910   |
| 29.49    | 4.315   |
| 29.49001 | 4.414   |
| 29.68999 | 6.750   |
| 29.69001 | 6.762   |
| 29.88999 | 6.766   |
| 29.89001 | 7.551   |
| 30.08999 | 7.593   |
| 30.09    | 7.601   |
| 30.29    | 9.551   |
| 30.49    | 11.057  |
| 30.49999 | 11.865  |

Table 2.11-3. Percentage of time that 11.7 GHz isolation was less than the indicated value for October, 1977.

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| ICTS     | PERCENT |
|----------|---------|
| 30.68999 | 12.643  |
| 30.69001 | 13.492  |
| 30.89001 | 14.157  |
| 31.08999 | 14.711  |
| 31.09    | 16.702  |
| 31.29    | 17.171  |
| 31.29999 | 17.496  |
| 31.49    | 18.156  |
| 31.68999 | 19.572  |
| 31.88999 | 20.188  |
| 31.89001 | 21.299  |
| 32.08999 | 21.307  |
| 32.09    | 21.837  |
| 32.1     | 22.755  |
| 32.29    | 23.066  |
| 32.49    | 24.458  |
| 32.49999 | 25.355  |
| 32.68999 | 25.618  |
| 32.69001 | 26.095  |
| 32.7     | 27.826  |
| 32.88999 | 28.193  |
| 32.89001 | 28.929  |
| 32.9     | 29.717  |
| 33.08999 | 29.762  |
| 33.09    | 30.676  |
| 33.29    | 33.239  |
| 33.29999 | 33.905  |
| 33.49    | 34.025  |
| 33.49001 | 34.976  |
| 33.50001 | 35.386  |
| 33.68999 | 38.123  |
| 33.69001 | 40.253  |
| 33.69999 | 41.606  |
| 33.7     | 41.678  |
| 33.88999 | 41.714  |
| 33.89001 | 42.908  |
| 33.9     | 42.953  |
| 34.09    | 43.747  |
| 34.1     | 43.944  |
| 34.10001 | 44.217  |
| 34.29    | 46.953  |
| 34.30001 | 47.111  |
| 34.49    | 48.852  |
| 34.49001 | 51.603  |
| 34.49999 | 52.570  |
| 34.68999 | 52.724  |
| 34.69001 | 54.140  |
| 34.88999 | 54.292  |
| 34.89001 | 54.800  |
| 34.9     | 55.414  |
| 35.09    | 56.829  |
| 35.1     | 56.905  |
| 35.29    | 59.724  |
| 35.29999 | 60.640  |
| 35.30001 | 60.695  |

Table 2.11-3 (continued). Percentage of time that 11.7 GHz isolation was less than the indicated value for October, 1977.

Table 2.11-4. Regression equations for the month of October, 1977.

| Relationship                                             | 11.7 GHz                     |                |                | 19.04 GHz                        |                |                | 28.56 GHz                       |                |                |
|----------------------------------------------------------|------------------------------|----------------|----------------|----------------------------------|----------------|----------------|---------------------------------|----------------|----------------|
|                                                          | Equation                     | N <sub>s</sub> | R <sup>2</sup> | Equation                         | N <sub>s</sub> | R <sup>2</sup> | Equation                        | N <sub>s</sub> | R <sup>2</sup> |
| I on log <sub>10</sub> (A) for 3 < A < 30                | (1)                          |                |                | $I = 46.70 - 27.94 \log_{10}(A)$ | 826            | .65            | $I = 24.31 - 1.52 \log_{10}(A)$ | 1592           | .01            |
| A on R at equal probability levels.                      | $A = .58^* R^{.76}$          | 3              | .53            | $A = .21^* R^{1.0}$              | 11             | 7              | $A = .98^* R^{.80}$             | 9              | .90            |
| Attenuation scaling. A (11) at equal probability levels. |                              |                |                | $A(11) = 2.23^* A(19)^{.70}$     | 2              | .61            | $A(11) = .17^* A(28)^{1.28}$    | 3              | .75            |
| Attenuation scaling. A (19) at equal probability levels. |                              |                |                |                                  |                |                | $A(19) = .05^* A(28)^{1.70}$    | 7              | .96            |
| Attenuation scaling. A (19) at equal probability levels. | $A(19) = 1.25^* A(11)^{.87}$ |                | .61            |                                  |                |                |                                 |                |                |
| Attenuation scaling. A (28) at equal probability levels. | $A(28) = 6.05^* A(11)^{.58}$ | 3              | .75            |                                  |                |                |                                 |                |                |

[1] Data invalidated by intermittent spacecraft operation during eclipse period.

2.12 November, 1977

19 GHz data are questionable because of an intermittent failure in the local oscillator.

Table 2.12-1.

Key parameters for the month of November, 1977.

1. Rain Data

VPI&SU Accumulation, 94.79 mm

USWS Accumulation, 188.21 mm

Peak VPI&SU Rate, 67.78 mm/hr

Percent of monthly accumulation at

R > 10 mm/hr, 26.17%      R > 20 mm/hr, 8.69%      R > 50 mm/hr, 3.66%

R > 30 mm/hr, 4.49%      R > 40 mm/hr, 3.66%

2. Signal Data

| Channel | Monthly Mean<br>Co Signal, dBm | Maximum Fade,<br>dB | Minimum Isolation<br>While in Phaselock, dB |
|---------|--------------------------------|---------------------|---------------------------------------------|
| 11.7    | -81.31                         | 30.96               | 11.87                                       |
| 19.04V  | -86.37                         | 26.60               | 8.91                                        |
| 19.04H  | -89.20                         | -----               | -----                                       |
| 28.56   | -83.65                         | 32.78               | 18.72                                       |

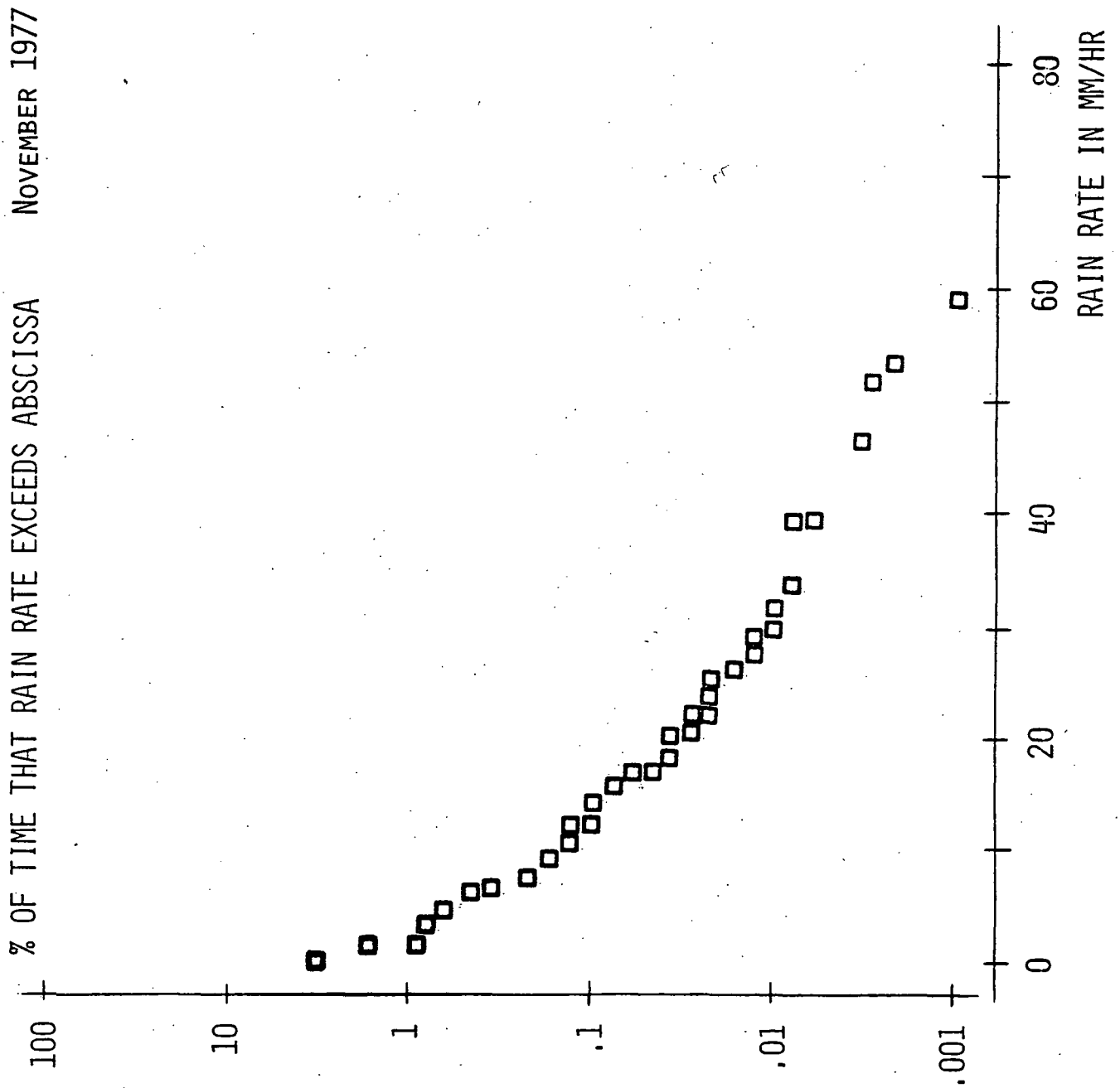


Figure 2.12-1. Rain rate statistics for November, 1977.

% OF TIME THAT ATTENUATION EXCEEDS ABSCISSA

11.7 GHz

19 GHz

28 GHz

NOVEMBER 1977

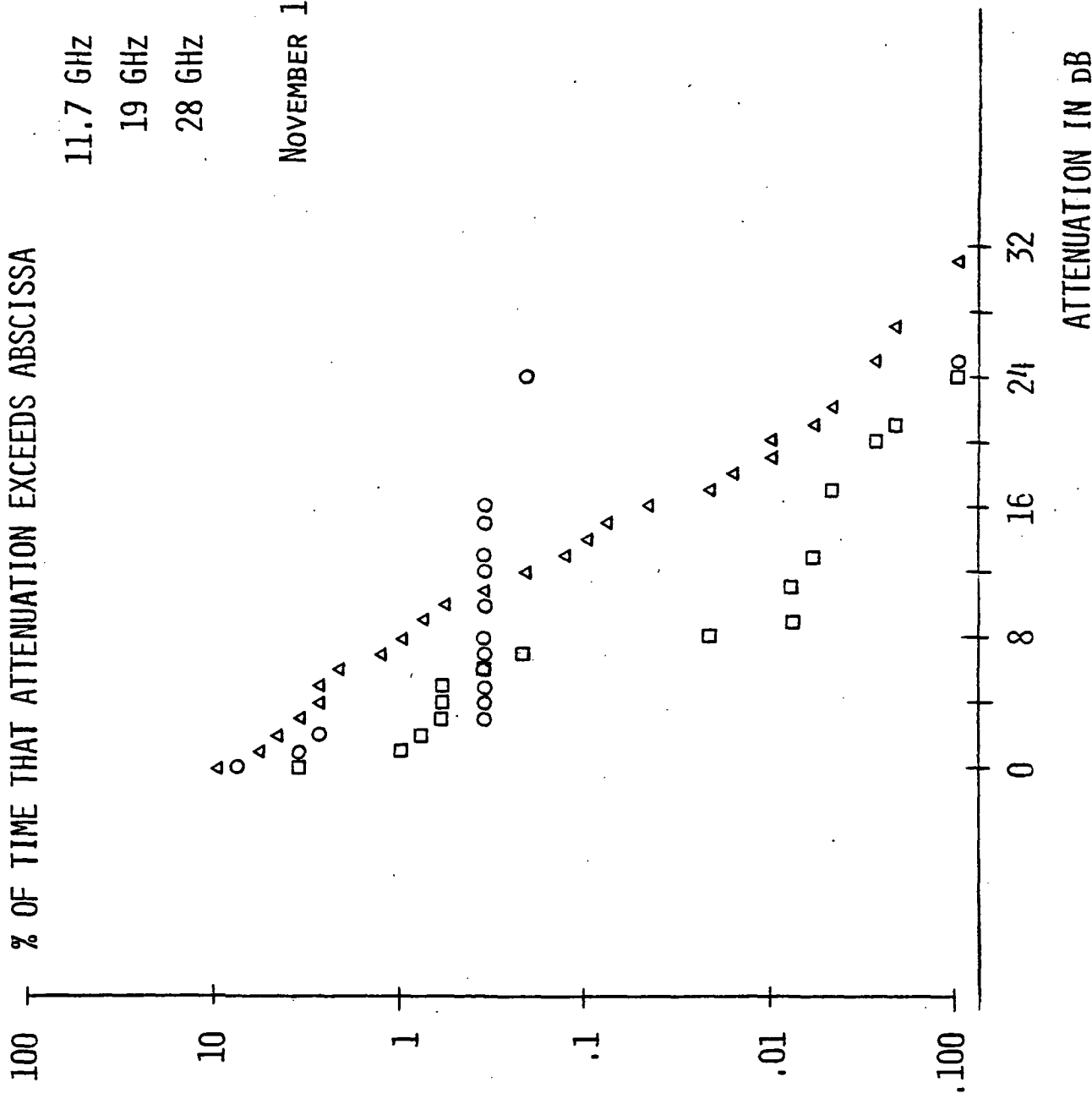


Figure 2.12-2. Attenuation statistics for November, 1977.

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| RAIN | ACTS | AV19 | AC28 | PER    |
|------|------|------|------|--------|
| .    | .    | .    | 0    | 11.264 |
| .    | .    | 0    | .    | 7.748  |
| .    | .    | .    | 1    | 6.034  |
| .    | .    | .    | 2    | 4.390  |
| .    | .    | .    | 3    | 3.830  |
| .    | .    | 1    | .    | 3.575  |
| .    | 0    | .    | .    | 3.278  |
| .    | .    | .    | 4    | 3.132  |
| 0    | .    | 2    | .    | 2.762  |
| .    | .    | .    | .    | 2.564  |
| .    | .    | .    | 5    | 2.501  |
| 1    | .    | .    | 6    | 1.977  |
| .    | .    | .    | .    | 1.535  |
| 2    | .    | .    | 7    | 1.452  |
| .    | 1    | .    | .    | 1.133  |
| .    | .    | .    | .    | 1.098  |
| 3    | .    | .    | 8    | 0.979  |
| .    | .    | .    | .    | 0.876  |
| .    | 2    | .    | 9    | 0.722  |
| 4    | .    | .    | .    | 0.719  |
| .    | 3    | .    | .    | 0.683  |
| .    | 4    | .    | .    | 0.626  |
| .    | .    | .    | .    | 0.580  |
| .    | 5    | .    | 10   | 0.546  |
| 5    | .    | .    | .    | 0.531  |
| .    | .    | .    | .    | 0.496  |
| .    | 6    | 3    | .    | 0.408  |
| .    | .    | .    | .    | 0.384  |
| 6    | .    | .    | 11   | 0.367  |
| .    | .    | .    | .    | 0.364  |
| .    | .    | 4    | .    | 0.352  |
| .    | .    | 5    | .    | 0.345  |
| .    | .    | 6    | .    | 0.343  |
| .    | .    | 7    | .    | 0.339  |
| .    | .    | 8    | .    | 0.338  |
| .    | .    | 10   | .    | 0.337  |
| .    | .    | 12   | .    | 0.336  |
| .    | .    | 13   | .    | 0.335  |
| .    | .    | 15   | .    | 0.334  |
| .    | .    | 16   | .    | 0.332  |
| 7    | .    | .    | .    | 0.243  |
| .    | .    | .    | 12   | 0.236  |
| .    | .    | 24   | .    | 0.232  |
| .    | 7    | .    | .    | 0.201  |
| 8    | .    | .    | .    | 0.182  |
| 9    | .    | .    | .    | 0.153  |
| .    | .    | .    | 13   | 0.144  |
| 10   | .    | .    | .    | 0.133  |
| 11   | .    | .    | .    | 0.124  |
| 12   | .    | .    | 14   | 0.109  |
| 13   | .    | .    | .    | 0.092  |
| 14   | .    | .    | .    | 0.077  |
| 15   | .    | .    | 15   | 0.070  |
| .    | .    | .    | .    | 0.066  |

Table 2.12-2. Attenuation and rain rate  
percent-of-time data for  
November, 1977.



| RAIN | ACTS | AV19 | AC28 | PER   |
|------|------|------|------|-------|
| 16   | .    | .    | .    | 0.049 |
| 17   | .    | .    | .    | 0.043 |
| .    | .    | .    | 16   | 0.042 |
| 18   | .    | .    | .    | 0.035 |
| 19   | .    | .    | .    | 0.034 |
| 20   | .    | .    | .    | 0.028 |
| 21   | .    | .    | .    | 0.026 |
| 22   | .    | .    | .    | 0.025 |
| 23   | .    | .    | 17   | 0.023 |
| .    | 8    | .    | .    | 0.021 |
| 24   | .    | .    | .    | 0.020 |
| 25   | .    | .    | 18   | 0.016 |
| 26   | .    | .    | .    | 0.014 |
| 27   | .    | .    | .    | 0.012 |
| 29   | .    | .    | 19   | 0.011 |
| 30   | .    | .    | .    | 0.010 |
| .    | .    | .    | 20   | 0.009 |
| 31   | 9    | .    | .    | 0.008 |
| 33   | 11   | .    | .    | 0.007 |
| 38   | 13   | .    | 21   | 0.006 |
| 52   | 17   | .    | 22   | 0.005 |
| 61   | 20   | .    | 25   | 0.003 |
| 66   | 21   | .    | 27   | 0.002 |
| 80   | 24   | 25   | 31   | 0.001 |
| 85   | 30   | 26   | 32   | 0.000 |

Table 2.12-2 (continued). Attenuation and rain rate percent-of-time data for November, 1977.

| ICTS     | PERCENT |
|----------|---------|
| 11.87    | 0.003   |
| 12.27    | 0.006   |
| 12.67    | 0.009   |
| 16.07    | 0.012   |
| 17.48    | 0.014   |
| 21.28    | 0.017   |
| 22.68    | 0.020   |
| 22.88    | 0.029   |
| 23.07999 | 0.038   |
| 23.68    | 0.084   |
| 23.88    | 0.110   |
| 24.29    | 0.165   |
| 24.68    | 0.361   |
| 25.29    | 0.450   |
| 25.48    | 0.494   |
| 25.89001 | 0.517   |
| 26.09    | 0.557   |
| 26.68    | 0.606   |
| 26.89001 | 0.647   |
| 27.48    | 0.655   |
| 27.49    | 0.675   |
| 27.49001 | 0.678   |
| 27.68999 | 0.742   |
| 27.69001 | 0.771   |
| 27.88    | 0.892   |
| 28.29    | 1.013   |
| 28.49    | 1.157   |
| 28.68999 | 1.657   |
| 29.08999 | 1.660   |
| 29.09    | 1.697   |
| 29.29    | 1.965   |
| 29.49    | 2.173   |
| 29.49001 | 2.176   |
| 29.68999 | 2.214   |
| 29.89001 | 2.445   |
| 30.08999 | 2.447   |
| 30.09    | 2.912   |
| 30.29    | 3.097   |
| 30.49    | 3.339   |
| 30.49001 | 3.368   |
| 30.68999 | 4.482   |
| 30.69001 | 5.048   |
| 30.88999 | 5.051   |
| 30.89001 | 5.530   |
| 31.08999 | 5.602   |
| 31.09    | 6.982   |
| 31.29    | 9.279   |
| 31.29999 | 9.288   |
| 31.49    | 10.967  |
| 31.68999 | 11.002  |
| 31.69001 | 12.454  |
| 31.88999 | 13.086  |
| 31.89001 | 15.554  |

Table 2.12-3. Percentage of time that 11.7 GHz isolation was less than the indicated value for November, 1977.

Table 2.12-4. Regression Equations for the month of November, 1977.

| Relationship                                                   | 11.7 GHz                                                |                |                | 19.04 GHz                                              |                |                | 28.56 GHz                                              |                |                |
|----------------------------------------------------------------|---------------------------------------------------------|----------------|----------------|--------------------------------------------------------|----------------|----------------|--------------------------------------------------------|----------------|----------------|
|                                                                | Equation                                                | N <sub>s</sub> | R <sup>2</sup> | Equation                                               | N <sub>s</sub> | R <sup>2</sup> | Equation                                               | N <sub>s</sub> | R <sup>2</sup> |
| I on log <sub>10</sub> (A)<br>for 3 < A < 30                   | $I = 53.79 - 29.6 \log_{10}(A)$<br>R <sup>2</sup> = .57 | 581            | .57            | $I = 33.43 - 9.9 \log_{10}(A)$<br>R <sup>2</sup> = .15 | 144            | .15            | $I = 30.79 - .55 \log_{10}(A)$<br>R <sup>2</sup> = .00 | 3814           | .00            |
| A on R at equal<br>probability levels.                         | $A = .29 R^{1.03}$<br>R <sup>2</sup> = .98              | 7              | .98            | ID                                                     |                |                | $A = 4.72 R^{.42}$<br>R <sup>2</sup> = .96             | 9              | .96            |
| Attenuation scaling.<br>A (11) at equal<br>probability levels. |                                                         |                |                | ID                                                     |                |                | $A(11) = .12$<br>$A(28) = 1.58$                        | 5              | .91            |
| Attenuation scaling.<br>A (19) at equal<br>probability levels. | ID                                                      |                |                |                                                        |                |                | ID                                                     |                |                |
| Attenuation scaling.<br>A (28) at equal<br>probability levels. | $A(28) = 4.60$<br>$A(11) = .58$<br>R <sup>2</sup> = .91 | 5              | .91            | ID                                                     |                |                |                                                        |                |                |

ID: Insufficient Data

2.13 December, 1977

11.7 GHz data were invalidated by repeated spacecraft maneuvers for which we were not provided timely tracking information.

Table 2.13-1.

Key parameters for the month of December, 1977.

1. Rain Data

VPI&SU Accumulation, 33.13 mm

USWS Accumulation, 46.74 mm

Peak VPI&SU Rate, 15.98 mm/hr

Percent of monthly accumulation at

|                     |                  |                  |
|---------------------|------------------|------------------|
| R > 10 mm/hr, 2.35% | R > 20 mm/hr, 0% | R > 50 mm/hr, 0% |
| R > 30 mm/hr, 0%    | R > 40 mm/hr, 0% |                  |

2. Signal Data

| Channel | Monthly Mean<br>Co Signal, dBm | Maximum Fade,<br>dB | Minimum Isolation<br>While in Phaselock, dB |
|---------|--------------------------------|---------------------|---------------------------------------------|
| 11.7    | -81.74                         | 43.31*              | 10.27*                                      |
| 19.04V  | -87.57                         | 5.37                | 5.11                                        |
| 19.04H  | -92.74                         | 8.14                | -----                                       |
| 28.56   | -83.67                         | 29.05               | 15.11                                       |

\* Data were invalidated by spacecraft maneuvers.

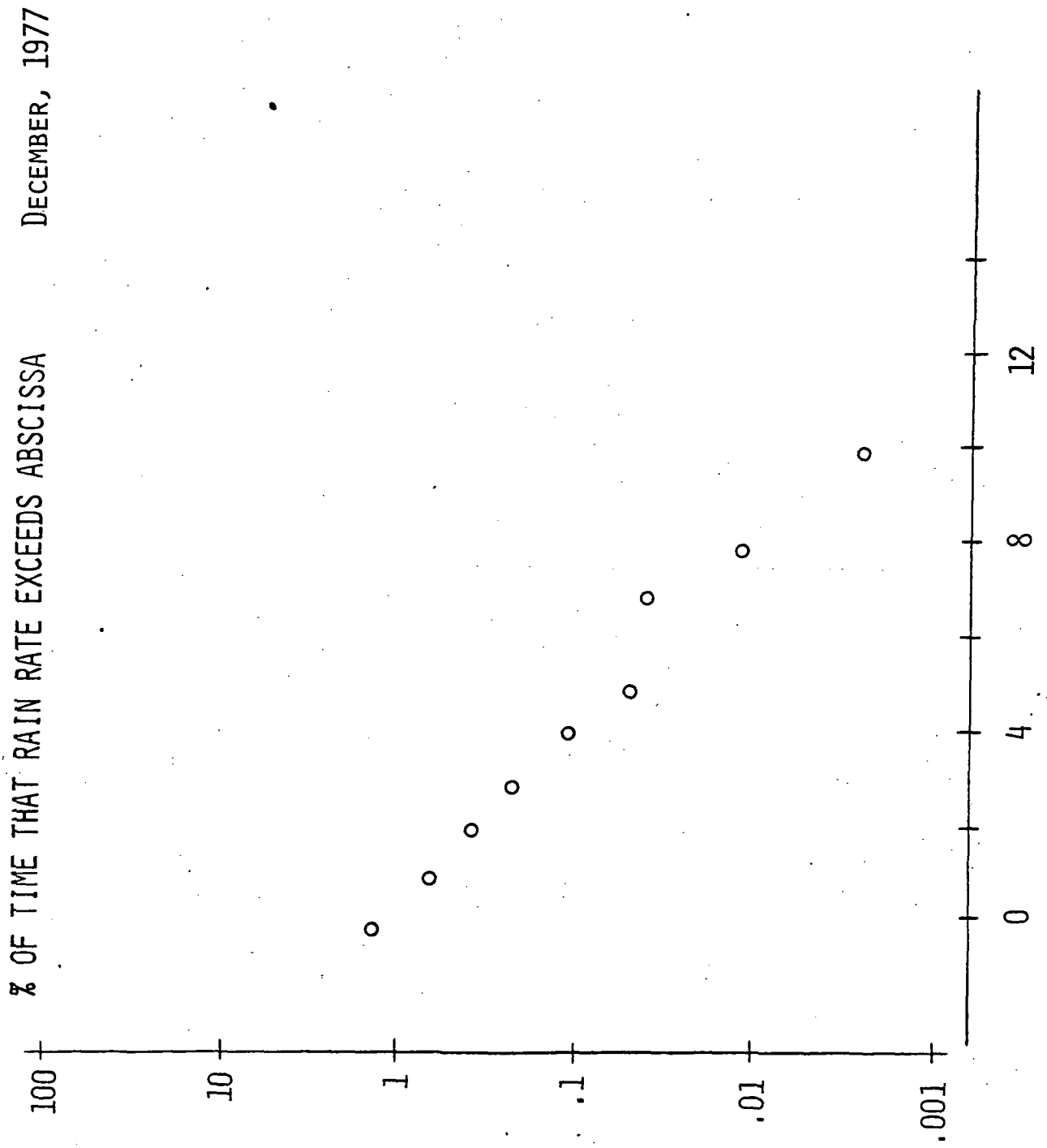


Figure 2.13-1. Rain rate statistics for December, 1977.

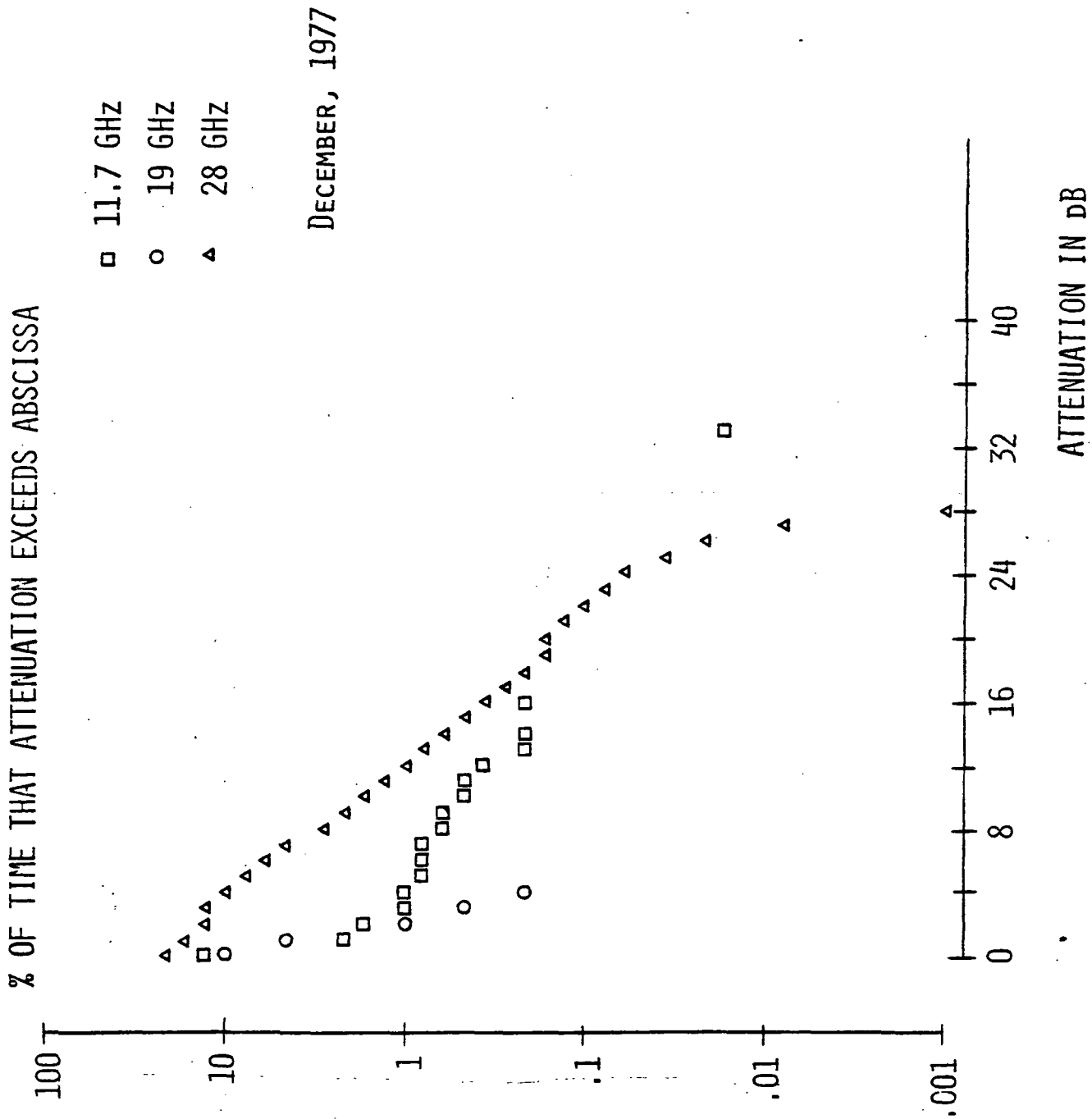


Figure 2.13-2. Attenuation statistics for December, 1977.  
Data for 11.7 GHz were invalidated by  
spacecraft maneuvers.

| RAIN | ACTS | AV19 | AC28 | PER    |
|------|------|------|------|--------|
| .    | .    | .    | 0    | 25.519 |
| .    | .    | .    | 1    | 18.743 |
| .    | .    | .    | 2    | 14.843 |
| .    | .    | .    | 3    | 11.722 |
| .    | .    | 0    | .    | 11.269 |
| .    | .    | .    | 4    | 9.383  |
| .    | .    | .    | 5    | 7.546  |
| .    | 0    | .    | .    | 6.469  |
| .    | .    | .    | 6    | 5.708  |
| .    | .    | 1    | .    | 4.936  |
| .    | .    | .    | 7    | 4.240  |
| .    | 1    | .    | .    | 3.075  |
| .    | 2    | .    | 8    | 2.906  |
| .    | .    | .    | .    | 2.259  |
| .    | 3    | .    | 9    | 2.084  |
| .    | .    | .    | 10   | 1.695  |
| 0    | 4    | .    | .    | 1.532  |
| .    | .    | .    | .    | 1.427  |
| .    | 5    | .    | .    | 1.321  |
| .    | .    | .    | 11   | 1.265  |
| .    | 6    | 2    | .    | 1.225  |
| .    | .    | .    | .    | 1.123  |
| .    | 7    | .    | .    | 1.106  |
| .    | .    | .    | 12   | 0.988  |
| .    | 8    | .    | .    | 0.774  |
| 1    | .    | .    | 13   | 0.740  |
| .    | 9    | .    | .    | 0.662  |
| .    | 10   | .    | 14   | 0.622  |
| .    | .    | .    | .    | 0.612  |
| .    | 11   | .    | .    | 0.599  |
| .    | .    | .    | 15   | 0.482  |
| .    | .    | .    | .    | 0.452  |
| .    | .    | 3    | .    | 0.430  |
| .    | .    | .    | 16   | 0.411  |
| 2    | .    | .    | .    | 0.337  |
| .    | .    | .    | 17   | 0.331  |
| .    | 12   | .    | .    | 0.273  |
| .    | 13   | .    | .    | 0.242  |
| .    | 14   | .    | .    | 0.241  |
| .    | 15   | .    | 18   | 0.235  |
| .    | 16   | .    | .    | 0.234  |
| 3    | .    | .    | .    | 0.232  |
| .    | .    | 4    | .    | 0.221  |
| .    | .    | .    | .    | 0.203  |
| .    | .    | .    | 19   | 0.198  |
| .    | .    | .    | 20   | 0.178  |
| .    | .    | .    | 21   | 0.152  |
| 4    | .    | .    | 22   | 0.120  |
| .    | .    | .    | .    | 0.089  |
| .    | .    | .    | 23   | 0.087  |
| .    | .    | .    | 24   | 0.069  |
| 5    | .    | .    | .    | 0.051  |
| .    | .    | .    | 25   | 0.041  |
| 7    | .    | .    | .    | 0.037  |

Table 2.13-2. Attenuation and rain rate percent-of-time data for December, 1977. Data for 11.7 GHz were invalidated by spacecraft maneuvers.



| RAIN | ACTS | AV19 | AC28 | PER   |
|------|------|------|------|-------|
| .    | .    | .    | 26   | 0.029 |
| .    | .    | .    | 27   | 0.017 |
| .    | 33   | .    | .    | 0.014 |
| .    | .    | .    | 28   | 0.012 |
| .    | .    | .    | 29   | 0.010 |
| 8    | .    | .    | .    | 0.009 |
| 10   | .    | .    | .    | 0.002 |
| 15   | 43   | 5    | 31   | 0.000 |

Table 2.13-2 (continued). Attenuation and rain rate percent-of-time data for December, 1977. Data for 11.7 GHz were invalidated by spacecraft maneuvers.

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| ICTS     | PERCENT |
|----------|---------|
| 10.27    | 0.002   |
| 10.87    | 0.004   |
| 12.27    | 0.011   |
| 12.67    | 0.012   |
| 13.47001 | 0.187   |
| 13.86999 | 0.189   |
| 14.07    | 0.297   |
| 14.46999 | 0.301   |
| 14.87    | 0.371   |
| 15.27    | 0.379   |
| 15.67    | 0.479   |
| 16.27    | 0.550   |
| 17.07    | 0.587   |
| 17.87    | 0.621   |
| 18.07    | 0.623   |
| 18.67    | 0.658   |
| 19.28    | 0.729   |
| 20.07999 | 0.732   |
| 20.08001 | 0.805   |
| 20.68999 | 0.847   |
| 21.68    | 0.909   |
| 22.27999 | 0.950   |
| 23.07999 | 0.953   |
| 23.48    | 1.105   |
| 23.89001 | 1.204   |
| 24.27999 | 1.206   |
| 24.49001 | 1.249   |
| 24.68    | 1.679   |
| 24.88999 | 1.680   |
| 25.07999 | 1.749   |
| 25.47999 | 1.928   |
| 25.49001 | 2.098   |
| 25.88    | 2.179   |
| 25.88999 | 2.206   |
| 26.08999 | 2.303   |
| 26.27999 | 3.240   |
| 26.29    | 3.382   |
| 26.68999 | 3.408   |
| 26.88    | 3.997   |
| 26.88001 | 4.059   |
| 26.88999 | 4.068   |
| 27.08999 | 4.270   |
| 27.09    | 4.277   |
| 27.29    | 4.696   |
| 27.49    | 4.767   |
| 27.68    | 5.244   |
| 27.68999 | 6.111   |
| 27.69001 | 6.286   |
| 27.88999 | 6.520   |
| 27.89001 | 6.942   |
| 28.08999 | 7.538   |
| 28.09    | 7.609   |
| 28.49    | 8.610   |

Table 2.13-3. Percentage of time that 11.7 GHz isolation was less than the indicated value for December, 1977.

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| ICTS     | PERCENT |
|----------|---------|
| 28.49001 | 8.787   |
| 28.68999 | 9.901   |
| 28.69001 | 10.536  |
| 28.88999 | 10.642  |
| 28.89001 | 10.782  |
| 29.09    | 11.288  |
| 29.29    | 13.600  |
| 29.49    | 15.186  |
| 29.49001 | 15.430  |
| 29.68999 | 15.457  |
| 29.69001 | 15.565  |
| 29.88999 | 16.156  |
| 29.89001 | 16.815  |
| 30.09    | 22.330  |
| 30.29    | 25.921  |
| 30.49    | 26.354  |
| 30.49001 | 26.837  |
| 30.68999 | 28.204  |
| 30.69001 | 28.402  |
| 30.88999 | 28.404  |
| 30.89001 | 32.125  |
| 31.09    | 35.300  |
| 31.29    | 35.847  |
| 31.49    | 43.417  |
| 31.68999 | 43.804  |
| 31.69001 | 48.145  |
| 31.88999 | 48.635  |
| 31.89001 | 51.035  |
| 32.08999 | 51.036  |
| 32.09    | 53.308  |
| 32.1     | 53.973  |
| 32.29    | 59.151  |
| 32.29999 | 59.594  |
| 32.49    | 61.055  |
| 32.49001 | 61.907  |
| 32.68999 | 63.028  |
| 32.69001 | 65.250  |
| 32.88999 | 65.554  |
| 32.89001 | 66.021  |
| 32.9     | 66.191  |
| 33.09    | 67.822  |
| 33.1     | 69.274  |
| 33.29    | 70.112  |
| 33.49    | 71.745  |
| 33.49001 | 74.693  |
| 33.49999 | 74.769  |
| 33.68999 | 74.957  |
| 33.69999 | 75.931  |
| 33.88999 | 76.043  |
| 33.89001 | 76.678  |
| 33.9     | 77.180  |
| 34.09    | 78.510  |
| 34.29    | 81.467  |
| 34.49    | 81.591  |
| 34.68999 | 81.814  |

Table 2.13-3 (continued). Percentage of time that 11.7 GHz isolation was less than the indicated value for December, 1977.

| ICTS     | PERCENT |
|----------|---------|
| 32.09    | 17.383  |
| 32.1     | 17.392  |
| 32.29    | 19.828  |
| 32.29999 | 19.943  |
| 32.49    | 20.573  |
| 32.49001 | 20.688  |
| 32.50001 | 20.711  |
| 32.68999 | 21.297  |
| 32.69001 | 22.792  |
| 32.88999 | 23.147  |
| 32.89001 | 25.514  |
| 32.9     | 25.517  |
| 33.09    | 26.769  |
| 33.1     | 26.937  |
| 33.29    | 28.974  |
| 33.49    | 30.111  |
| 33.49001 | 30.472  |
| 33.50001 | 30.475  |
| 33.68999 | 32.224  |
| 33.69001 | 32.917  |
| 33.88999 | 33.754  |
| 33.89001 | 34.562  |
| 33.9     | 34.781  |
| 34.09    | 36.092  |
| 34.1     | 36.106  |
| 34.29    | 37.636  |
| 34.49    | 38.614  |
| 34.49001 | 38.626  |
| 34.68999 | 42.311  |
| 34.69001 | 43.789  |
| 34.7     | 43.896  |
| 34.88999 | 43.951  |
| 34.89001 | 46.791  |
| 34.9     | 46.802  |
| 35.09    | 48.765  |
| 35.29    | 49.521  |
| 35.49    | 51.853  |
| 35.49001 | 52.595  |
| 35.49999 | 52.647  |
| 35.50001 | 52.650  |
| 35.68999 | 53.002  |
| 35.69001 | 53.937  |
| 35.7     | 53.940  |
| 35.89001 | 56.370  |
| 35.9     | 56.390  |
| 36.08999 | 56.485  |
| 36.09    | 58.370  |
| 36.1     | 58.396  |
| 36.10001 | 58.402  |
| 36.29    | 62.408  |
| 36.29999 | 62.439  |
| 36.30001 | 62.465  |
| 36.49    | 62.659  |
| 36.49001 | 63.031  |
| 36.50001 | 63.034  |

Table 2.13-3 (continued). Percentage of time that 11.7 GHz isolation was less than the indicated value for December, 1977.

Table 2.13-4. Regression equations for the month of December, 1977.

| Relationship                                                   | 11.7 GHz                                   |                |                | 19.04 GHz                               |                |                | 28.56 GHz                               |                |                |
|----------------------------------------------------------------|--------------------------------------------|----------------|----------------|-----------------------------------------|----------------|----------------|-----------------------------------------|----------------|----------------|
|                                                                | Equation                                   | N <sub>s</sub> | R <sup>2</sup> | Equation                                | N <sub>s</sub> | R <sup>2</sup> | Equation                                | N <sub>s</sub> | R <sup>2</sup> |
| I on log <sub>10</sub> (A)<br>for 3 < A < 30                   | * I = 35.79 -<br>19.20 log <sub>10</sub> A | 1181           | .95            | I = 37.06 -<br>9.78 log <sub>10</sub> A | 830            | .65            | I = 33.34 -<br>1.87 log <sub>10</sub> A | 12338          | 0              |
| A on R at equal<br>probability levels.                         | *                                          |                |                | ID                                      |                |                | ID                                      |                |                |
| Attenuation scaling.<br>A (11) at equal<br>probability levels. | *                                          |                |                | *                                       |                |                | *                                       |                |                |
| Attenuation scaling.<br>A (19) at equal<br>probability levels. | *                                          |                |                | ID                                      |                |                | ID                                      |                |                |
| Attenuation scaling.<br>A (28) at equal<br>probability levels. | *                                          |                |                | ID                                      |                |                | ID                                      |                |                |

\* Data were invalidated by spacecraft maneuvers.

ID: Insufficient Data

2.14 January, 1978

All data are valid. We noted occasionally severe depolarization and attenuation events caused by sleet, freezing rain, and snow which of course are not reflected on our rain statistics. The attenuation values are valid but they do not correlate well with the rain data. [All known instances of data contamination by snow or ice on the antenna surfaces have been removed from the data base.] The same comment applies to the months of February and March, 1978, as well.

Table 2.14-1.

Key parameters for the month of January, 1978.

1. Rain Data

VPI&SU Accumulation, 102.77 mm (includes melted snow)

USWS Accumulation, 110.49 mm (279.4 mm of snow)

Peak VPI&SU Rate, 36 mm/hr

Percent of monthly accumulation at

R > 10 mm/hr, 8.27%      R > 20 mm/hr, 2.51 %      R > 50 mm/hr, 0%

R > 30 mm/hr, .29%      R > 40 mm/hr, 0%

2. Signal Data

| Channel | Monthly Mean<br>Co Signal, dBm | Maximum Fade,<br>dB | Minimum Isolation<br>While in Phaselock, dB |
|---------|--------------------------------|---------------------|---------------------------------------------|
| 11.7    | -85.81                         | 12                  | 8.07                                        |
| 19.04V  | -88.10                         | 33                  | 5.71                                        |
| 19.04H  | -92.45                         | --                  | ----                                        |
| 28.56   | -83.68                         | 46                  | 7.71                                        |

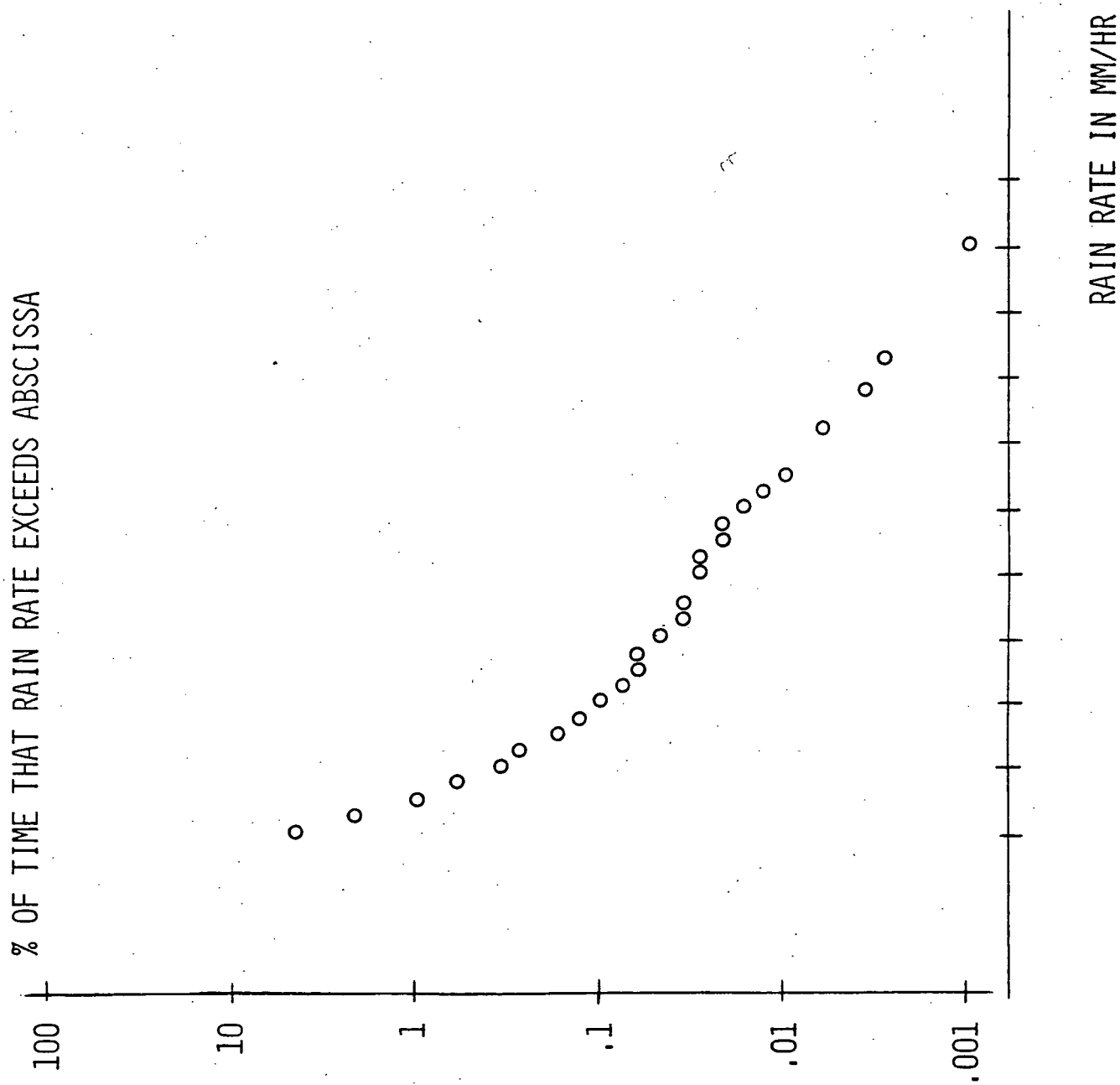


Figure 2.14-1. Rain rate statistics for January, 1978.



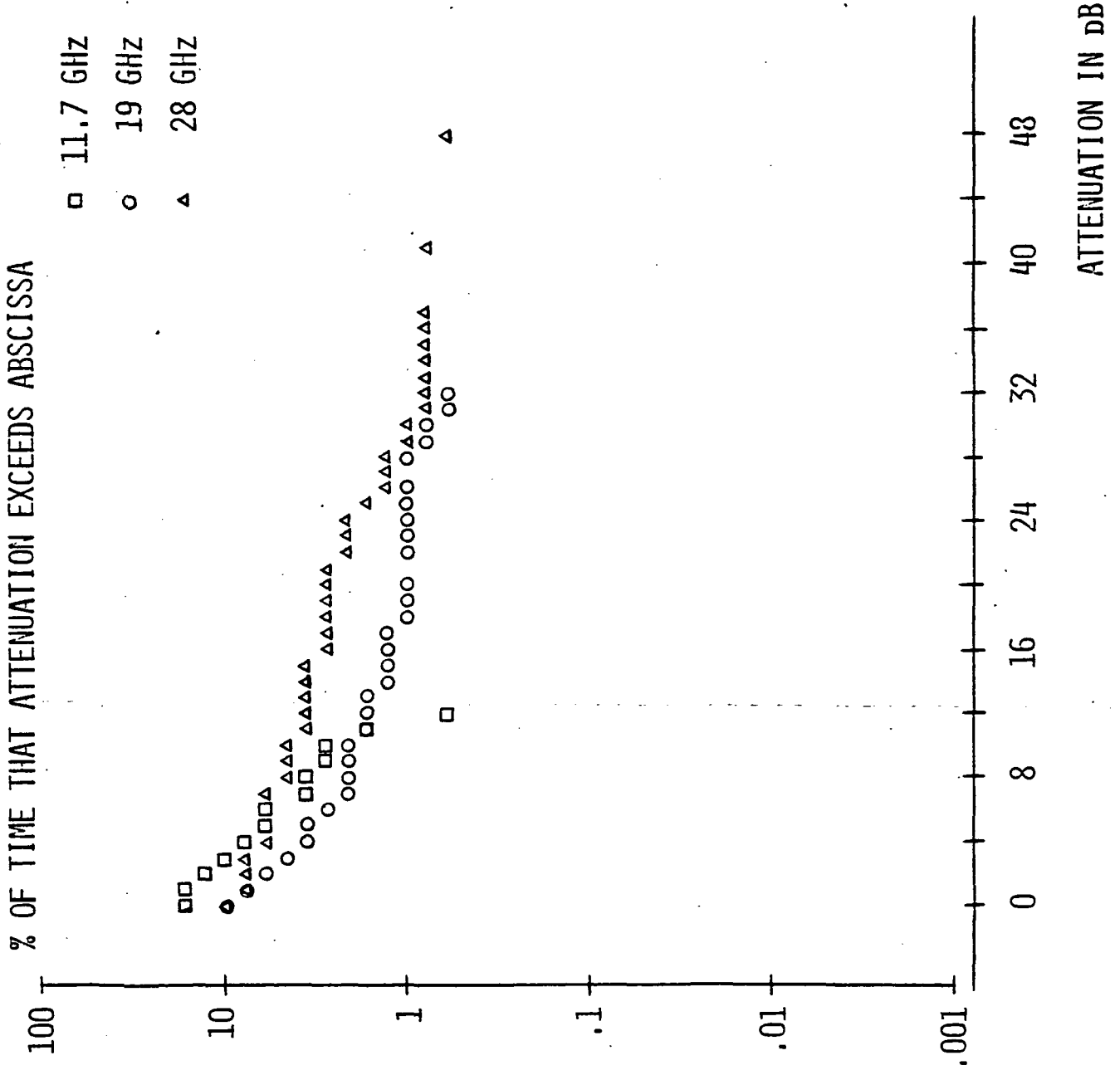


Figure 2.14-2. Attenuation statistics for January, 1978.

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| RAIN | ACTS | AV19 | AC28 | PER    |
|------|------|------|------|--------|
| .    | 0    | .    | .    | 18.021 |
| .    | 1    | .    | .    | 14.986 |
| .    | 2    | .    | .    | 12.251 |
| .    | .    | 0    | .    | 10.567 |
| .    | .    | .    | 0    | 10.233 |
| .    | 3    | .    | .    | 10.227 |
| .    | 4    | .    | .    | 8.617  |
| .    | .    | 1    | .    | 8.488  |
| .    | .    | .    | 1    | 8.116  |
| .    | .    | .    | 2    | 7.147  |
| .    | .    | .    | 3    | 6.870  |
| .    | .    | .    | 4    | 6.544  |
| .    | .    | .    | 5    | 6.235  |
| .    | 5    | .    | .    | 6.222  |
| .    | .    | .    | 6    | 5.909  |
| .    | .    | 2    | .    | 5.572  |
| .    | 6    | .    | .    | 5.463  |
| .    | .    | .    | 7    | 5.427  |
| .    | .    | 3    | .    | 5.174  |
| 0    | .    | .    | 8    | 5.024  |
| .    | .    | .    | 9    | 4.955  |
| .    | .    | .    | 10   | 4.665  |
| .    | 7    | .    | .    | 4.326  |
| .    | .    | .    | 11   | 3.928  |
| .    | .    | .    | 12   | 3.880  |
| .    | .    | .    | 13   | 3.654  |
| .    | .    | .    | 14   | 3.492  |
| .    | 8    | .    | .    | 3.420  |
| .    | .    | .    | 15   | 3.400  |
| .    | .    | 4    | .    | 3.394  |
| .    | .    | 5    | .    | 3.270  |
| .    | .    | .    | 16   | 3.206  |
| .    | 9    | .    | .    | 3.152  |
| .    | .    | .    | 17   | 3.096  |
| .    | .    | .    | 18   | 3.066  |
| .    | .    | .    | 19   | 2.988  |
| .    | .    | .    | 20   | 2.899  |
| .    | .    | 6    | .    | 2.782  |
| .    | 10   | .    | .    | 2.672  |
| .    | .    | .    | 21   | 2.642  |
| .    | .    | .    | 22   | 2.630  |
| .    | .    | 7    | .    | 2.346  |
| .    | .    | 8    | .    | 2.283  |
| .    | .    | .    | 23   | 2.212  |
| .    | .    | 9    | .    | 2.152  |
| .    | .    | 10   | .    | 2.115  |
| .    | .    | .    | 24   | 1.975  |
| 1    | .    | .    | .    | 1.906  |
| .    | .    | 11   | .    | 1.832  |
| .    | 11   | .    | .    | 1.766  |
| .    | .    | .    | .    | 1.656  |
| .    | .    | .    | 25   | 1.575  |
| .    | .    | 12   | .    | 1.527  |
| .    | .    | 13   | .    | 1.503  |

Table 2.14-2. Attenuation and rain rate percent-of-time data for January, 1978.

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| RAIN | ACTS | AV19 | AC28 | PER   |
|------|------|------|------|-------|
| .    | .    | 14   | 26   | 1.419 |
| .    | .    | 15   | .    | 1.368 |
| .    | .    | .    | 27   | 1.288 |
| .    | .    | 16   | 28   | 1.263 |
| .    | .    | 17   | .    | 1.175 |
| .    | .    | 18   | .    | 1.173 |
| .    | .    | 19   | .    | 1.141 |
| .    | .    | 20   | .    | 1.116 |
| .    | .    | 22   | .    | 1.114 |
| .    | .    | 23   | .    | 1.111 |
| .    | .    | 24   | .    | 1.109 |
| .    | .    | 25   | .    | 1.106 |
| .    | .    | 26   | .    | 1.069 |
| .    | .    | .    | 29   | 1.063 |
| 2    | .    | 28   | .    | 1.061 |
| .    | .    | .    | 30   | 0.992 |
| .    | .    | .    | 31   | 0.970 |
| .    | .    | 29   | 32   | 0.964 |
| .    | .    | .    | 33   | 0.936 |
| .    | .    | .    | 34   | 0.836 |
| .    | .    | 30   | 35   | 0.817 |
| .    | .    | .    | 36   | 0.764 |
| .    | .    | .    | 37   | 0.752 |
| .    | .    | 31   | 41   | 0.729 |
| .    | 12   | 32   | 48   | 0.722 |
| 3    | .    | .    | .    | 0.721 |
| 4    | .    | .    | .    | 0.705 |
| 5    | .    | .    | .    | 0.703 |
| 6    | .    | .    | .    | 0.702 |
| 7    | .    | .    | .    | 0.677 |
| 8    | .    | .    | .    | 0.667 |
| 9    | .    | .    | .    | 0.533 |
| 10   | .    | .    | .    | 0.365 |
| 11   | .    | .    | .    | 0.242 |
| 12   | .    | .    | .    | 0.184 |
| 13   | .    | .    | .    | 0.127 |
| 14   | .    | .    | .    | 0.097 |
| 15   | .    | .    | .    | 0.078 |
| 16   | .    | .    | .    | 0.064 |
| 17   | .    | .    | .    | 0.055 |
| 18   | .    | .    | .    | 0.050 |
| 19   | .    | .    | .    | 0.041 |
| 20   | .    | .    | .    | 0.036 |
| 21   | .    | .    | .    | 0.029 |
| 22   | .    | .    | .    | 0.024 |
| 25   | .    | .    | .    | 0.021 |
| 27   | .    | .    | .    | 0.015 |
| 29   | .    | .    | .    | 0.014 |
| 36   | 50   | 50   | 50   | 0.012 |
|      |      |      |      | 0.009 |
|      |      |      |      | 0.006 |
|      |      |      |      | 0.004 |
|      |      |      |      | 0.001 |
|      |      |      |      | 0.000 |

Table 2.14-2 (continued). Attenuation and rain rate  
percent-of-time data for  
January, 1978.

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| ICTS     | PERCENT |
|----------|---------|
| 8.069998 | 0.183   |
| 8.869986 | 0.932   |
| 9.669989 | 1.463   |
| 9.870001 | 1.829   |
| 10.27    | 1.922   |
| 10.47001 | 2.280   |
| 11.07    | 2.281   |
| 11.27    | 2.380   |
| 11.87    | 2.445   |
| 12.07    | 2.611   |
| 12.66999 | 2.736   |
| 12.67    | 2.738   |
| 12.87    | 2.852   |
| 13.27    | 2.927   |
| 13.47001 | 3.005   |
| 13.87    | 3.006   |
| 14.27001 | 3.140   |
| 14.67    | 3.181   |
| 14.87    | 3.254   |
| 15.27    | 3.362   |
| 15.67    | 3.400   |
| 16.07    | 3.404   |
| 16.46999 | 3.440   |
| 16.87    | 3.514   |
| 16.88    | 4.340   |
| 17.27    | 4.416   |
| 17.47999 | 4.447   |
| 17.67    | 4.515   |
| 17.68    | 5.006   |
| 17.86999 | 5.082   |
| 18.27999 | 5.549   |
| 18.46999 | 5.575   |
| 18.66999 | 5.640   |
| 18.68    | 5.733   |
| 18.88    | 6.076   |
| 19.07    | 6.131   |
| 19.07999 | 6.565   |
| 19.46999 | 6.770   |
| 19.47999 | 7.259   |
| 19.48    | 7.632   |
| 19.88    | 7.763   |
| 19.88001 | 7.771   |
| 20.07999 | 8.896   |
| 20.27999 | 9.234   |
| 20.28    | 9.409   |
| 20.68    | 9.750   |
| 20.69001 | 9.780   |
| 20.88    | 10.601  |
| 20.88999 | 10.939  |
| 20.89001 | 11.023  |
| 21.07999 | 11.080  |
| 21.27999 | 11.188  |
| 21.48    | 11.259  |

Table 2.14-3. Percentage of time that 11.7 GHz isolation was less than the indicated value for January, 1978.

| ICTS     | PERCENT |
|----------|---------|
| 21.49    | 11.261  |
| 21.68    | 11.580  |
| 21.68999 | 11.733  |
| 21.69001 | 11.801  |
| 21.88    | 11.841  |
| 21.88999 | 11.845  |
| 21.89001 | 11.932  |
| 22.07999 | 11.990  |
| 22.08001 | 12.058  |
| 22.27999 | 12.136  |
| 22.28    | 12.528  |
| 22.29    | 12.633  |
| 22.48    | 12.701  |
| 22.49    | 13.287  |
| 22.68    | 13.639  |
| 22.68999 | 13.683  |
| 22.69001 | 13.795  |
| 22.88    | 14.593  |
| 22.88001 | 14.619  |
| 22.88999 | 14.669  |
| 23.07999 | 14.893  |
| 23.08001 | 15.017  |
| 23.08999 | 15.222  |
| 23.09    | 15.321  |
| 23.27999 | 15.359  |
| 23.28    | 15.574  |
| 23.29    | 16.252  |
| 23.48    | 18.779  |
| 23.49    | 19.005  |
| 23.68    | 19.530  |
| 23.68999 | 19.546  |
| 23.69001 | 19.572  |
| 23.88    | 19.641  |
| 23.88999 | 19.778  |
| 23.89001 | 19.907  |
| 24.07999 | 20.592  |
| 24.08001 | 20.670  |
| 24.08999 | 21.074  |
| 24.09    | 21.776  |
| 24.27999 | 22.489  |
| 24.28    | 23.334  |
| 24.29    | 23.785  |
| 24.47999 | 23.861  |
| 24.48    | 23.954  |
| 24.49    | 24.148  |
| 24.68    | 24.268  |
| 24.68999 | 25.045  |
| 24.69001 | 25.083  |
| 24.88    | 25.170  |
| 24.88999 | 25.975  |
| 24.89001 | 26.672  |
| 25.07999 | 27.338  |
| 25.09    | 28.803  |
| 25.27999 | 28.932  |
| 25.29    | 29.145  |

Table 2.14-3 (continued). Percentage of time that 11.7 GHz isolation was less than the indicated value for January, 1978.

| ICTS     | PERCENT |
|----------|---------|
| 25.47999 | 29.153  |
| 25.48    | 29.160  |
| 25.49    | 29.769  |
| 25.49001 | 30.009  |
| 25.68    | 30.256  |
| 25.68999 | 30.892  |
| 25.69001 | 30.919  |
| 25.88    | 31.158  |
| 25.88999 | 31.588  |
| 25.89001 | 33.427  |
| 26.09    | 33.621  |
| 26.27999 | 33.784  |
| 26.29    | 35.010  |
| 26.49    | 35.438  |
| 26.49001 | 35.499  |
| 26.68    | 35.520  |
| 26.68999 | 37.959  |
| 26.69001 | 38.303  |
| 26.88999 | 38.342  |
| 26.89001 | 39.053  |
| 27.07999 | 39.124  |
| 27.08999 | 39.654  |
| 27.09    | 40.298  |
| 27.27999 | 40.341  |
| 27.29    | 41.384  |
| 27.48    | 41.386  |
| 27.49    | 43.355  |
| 27.68999 | 43.696  |
| 27.69001 | 44.274  |
| 27.88999 | 45.599  |
| 27.89001 | 46.118  |
| 28.07999 | 46.154  |
| 28.09    | 46.866  |
| 28.28    | 46.889  |
| 28.29    | 48.641  |
| 28.49    | 49.623  |
| 28.49001 | 49.833  |
| 28.68999 | 50.949  |
| 28.69001 | 51.210  |
| 28.88    | 51.214  |
| 28.88999 | 51.469  |
| 28.89001 | 52.723  |
| 29.08999 | 52.725  |
| 29.09    | 54.454  |
| 29.29    | 57.238  |
| 29.49    | 59.156  |
| 29.49001 | 59.194  |
| 29.68999 | 60.543  |
| 29.69001 | 62.020  |
| 29.88999 | 62.629  |
| 29.89001 | 64.054  |
| 30.08999 | 64.419  |
| 30.09    | 66.604  |
| 30.29    | 66.872  |
| 30.49    | 68.436  |

Table 2.14-3 (continued). Percentage of time that 11.7 GHz isolation was less than the indicated value for January, 1978.

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| ICTS     | PERCENT |
|----------|---------|
| 30.49001 | 68.632  |
| 30.68999 | 69.719  |
| 30.69001 | 71.365  |
| 30.88999 | 71.401  |
| 30.89001 | 72.523  |
| 31.08999 | 72.529  |
| 31.09    | 73.024  |
| 31.29    | 75.224  |
| 31.49    | 75.558  |
| 31.49001 | 76.474  |
| 31.68999 | 76.892  |
| 31.69001 | 78.074  |
| 31.88999 | 78.321  |
| 31.89001 | 78.611  |
| 31.9     | 78.654  |
| 32.09    | 80.905  |
| 32.29    | 82.519  |
| 32.49    | 82.875  |
| 32.49001 | 83.293  |
| 32.68999 | 83.457  |
| 32.69001 | 85.641  |
| 32.7     | 85.649  |
| 32.89001 | 86.892  |
| 33.09    | 87.925  |
| 33.1     | 88.205  |
| 33.29    | 88.340  |
| 33.29999 | 88.342  |
| 33.49    | 88.623  |
| 33.49001 | 89.552  |
| 33.49999 | 89.594  |
| 33.68999 | 89.639  |
| 33.69001 | 89.843  |
| 33.7     | 89.871  |
| 33.89001 | 90.494  |
| 33.9     | 90.985  |
| 34.08999 | 91.007  |
| 34.09    | 91.177  |
| 34.1     | 91.321  |
| 34.29    | 92.073  |
| 34.29999 | 92.090  |
| 34.49    | 92.122  |
| 34.49001 | 92.195  |
| 34.49999 | 92.197  |
| 34.50001 | 92.237  |
| 34.68999 | 92.240  |
| 34.69001 | 92.379  |
| 34.69999 | 92.381  |
| 34.7     | 92.636  |
| 34.88999 | 92.649  |
| 34.89001 | 92.695  |
| 34.9     | 93.022  |
| 35.09    | 95.256  |
| 35.1     | 95.344  |
| 35.29    | 95.355  |
| 35.29999 | 95.407  |

Table 2.14-3 (continued). Percentage of time that 11.7 GHz isolation was less than the indicated value for January, 1978.

Table 2.14-4. Regression equations for the month of January, 1978.

| Relationship                                                | 11.7 GHz                           |                |                | 19.04 GHz                          |                |                | 28.56 GHz                          |                |                |
|-------------------------------------------------------------|------------------------------------|----------------|----------------|------------------------------------|----------------|----------------|------------------------------------|----------------|----------------|
|                                                             | Equation                           | N <sub>s</sub> | R <sup>2</sup> | Equation                           | N <sub>s</sub> | R <sup>2</sup> | Equation                           | N <sub>s</sub> | R <sup>2</sup> |
| I on log <sub>10</sub> (A)<br>for 3 < A < 30                | $I = 34.53 - 18.83^* \log_{10}(A)$ | 9338           | .46            | $I = 40.41 - 16.40^* \log_{10}(A)$ | 2824           | .71            | $I = 49.49 - 22.53^* \log_{10}(A)$ | 3807           | .63            |
| A on R at equal probability levels.                         | ID                                 |                |                | ID                                 |                |                | ID                                 |                |                |
| Attenuation scaling.<br>A (11) at equal probability levels. |                                    |                |                | $A(11) = .74^* A(19)^{.97}$        | 3              | .65            | ID                                 |                |                |
| Attenuation scaling.<br>A (19) at equal probability levels. | ID                                 |                |                |                                    |                |                | ID                                 |                |                |
| Attenuation scaling.<br>A (28) at equal probability levels. | ID                                 |                |                | ID                                 |                |                |                                    |                |                |



2.15 February, 1978

11.7 GHz data may have been influenced by daily spacecraft shutdown for eclipse. See comments for January, 1978.

Table 2.15-1.

Key parameters for the month of February, 1978.

1. Rain Data

VPI&SU Accumulation, 8.33 mm (includes melted snow)

USWS Accumulation, 14.99 mm (127.0 mm of snow)

Peak VPI&SU Rate, 4.51 mm/hr

Percent of monthly accumulation at

R > 10 mm/hr, 0%      R > 20 mm/hr, 0%      R > 50 mm/hr, 0%

R > 30 mm/hr, 0%      R > 40 mm/hr, 0%

2. Signal Data

| Channel | Monthly Mean<br>Co Signal, dBm | Maximum Fade,<br>dB | Minimum Isolation<br>While in Phaselock, dB |
|---------|--------------------------------|---------------------|---------------------------------------------|
| 11.7    | -83.76                         | 50                  | 11.48                                       |
| 19.04V  | -87.85                         | 50                  | 3.70                                        |
| 19.04H  | -93.08                         | 50                  | -----                                       |
| 28.56   | -82.92                         | 50                  | 19.52                                       |

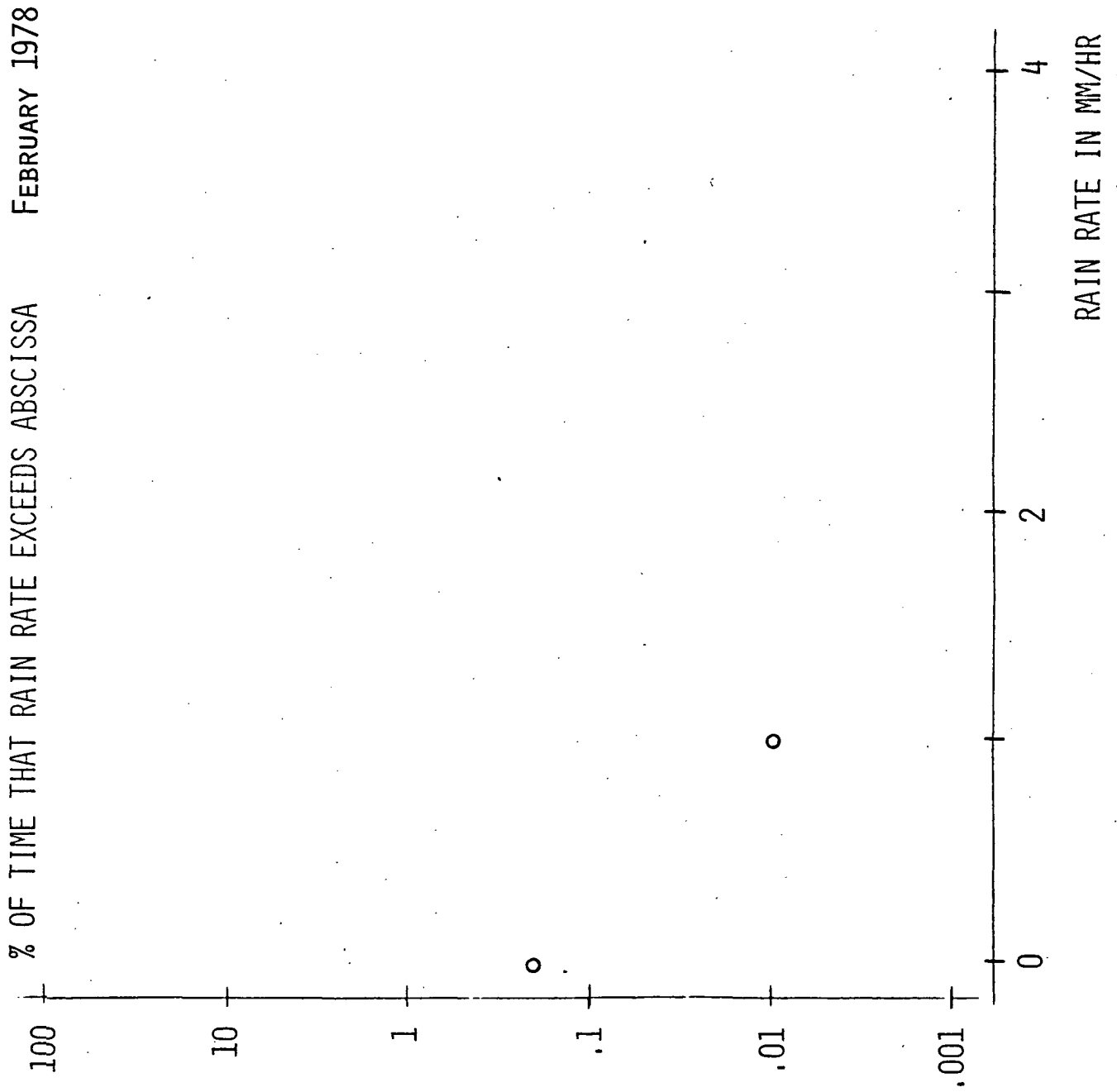


Figure 2.15-1. Rain rate statistics for February, 1978.

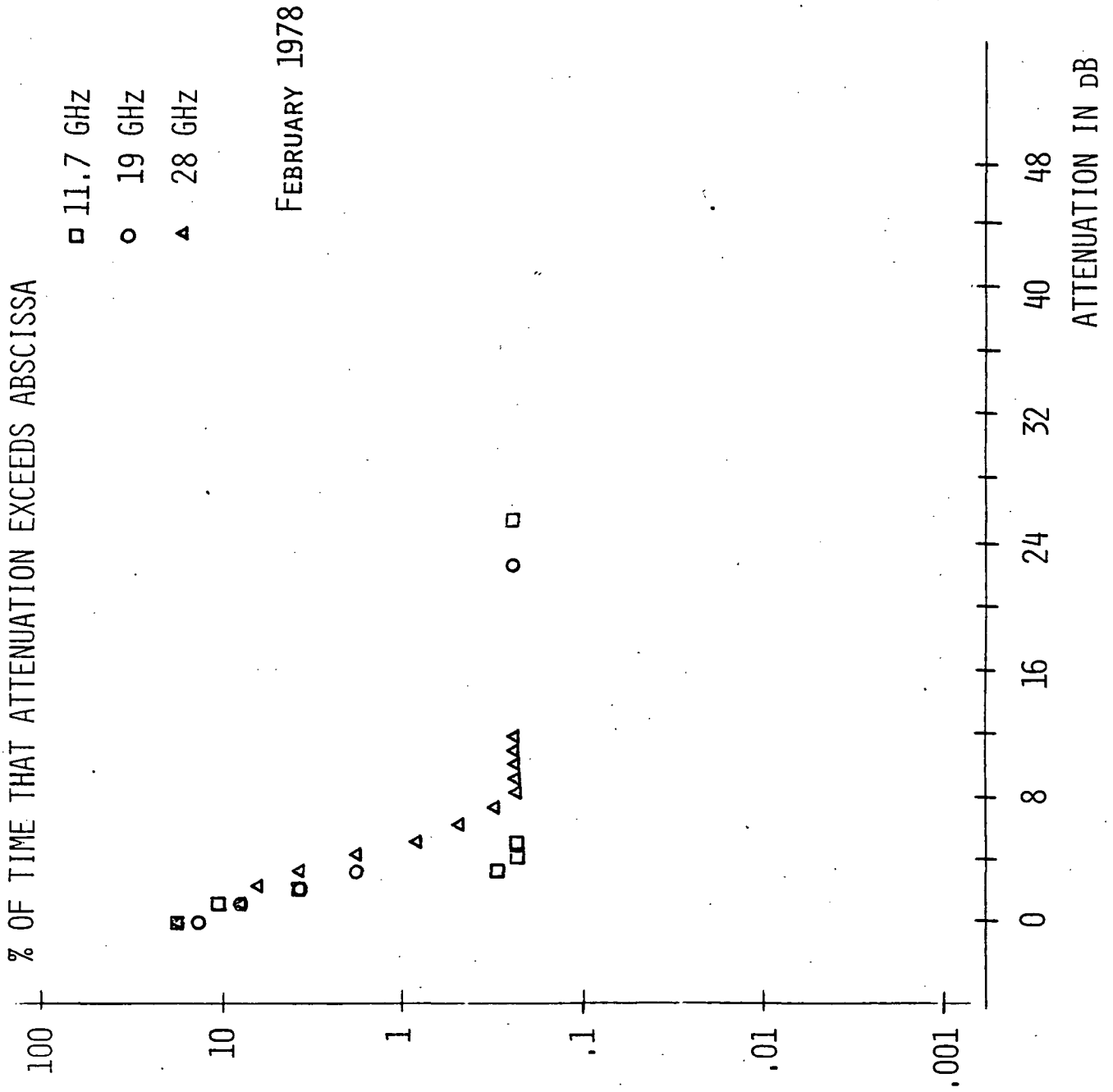


Figure 2.15-2. Attenuation statistics for February, 1978.

| RAIN | ACTS | AV19 | AC28 | PER    |
|------|------|------|------|--------|
| .    | 0    | .    | 0    | 18.478 |
| .    | .    | 0    | .    | 17.583 |
| .    | 1    | .    | .    | 12.407 |
| .    | .    | .    | 1    | 9.365  |
| .    | .    | 1    | .    | 8.762  |
| .    | .    | .    | 2    | 8.505  |
| .    | 2    | 2    | .    | 5.905  |
| .    | .    | .    | 3    | 3.340  |
| .    | .    | .    | 4    | 3.302  |
| .    | .    | 3    | .    | 3.222  |
| .    | .    | .    | 5    | 1.870  |
| .    | .    | .    | 6    | 1.505  |
| .    | .    | .    | 7    | 0.846  |
| .    | 3    | .    | 8    | 0.429  |
| .    | .    | .    | 9    | 0.286  |
| .    | .    | .    | 10   | 0.267  |
| .    | 4    | 4    | .    | 0.242  |
| .    | .    | .    | .    | 0.226  |
| .    | 5    | 5    | .    | 0.218  |
| 0    | 25   | 22   | 11   | 0.217  |
| 1    | .    | .    | .    | 0.216  |
| .    | 50   | 50   | 50   | 0.007  |
| .    | .    | .    | .    | 0.000  |

Table 2.15-2. Attenuation and rain rate percent-of-time data for February, 1978.

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| ICTS     | PERCENT |
|----------|---------|
| 11.48    | 0.002   |
| 23.09    | 0.004   |
| 23.68    | 0.279   |
| 24.47999 | 0.405   |
| 24.48    | 0.569   |
| 24.68    | 0.718   |
| 24.88999 | 1.428   |
| 25.08001 | 1.816   |
| 25.29    | 1.869   |
| 25.47999 | 2.014   |
| 25.48    | 2.173   |
| 25.68999 | 3.425   |
| 25.69001 | 3.448   |
| 25.88    | 4.015   |
| 25.89001 | 4.054   |
| 26.09    | 4.428   |
| 26.28    | 4.894   |
| 26.29    | 5.860   |
| 26.49    | 7.194   |
| 26.69001 | 7.666   |
| 26.88    | 7.910   |
| 26.89001 | 8.380   |
| 27.09    | 9.411   |
| 27.29    | 10.679  |
| 27.49    | 11.647  |
| 27.49001 | 12.002  |
| 27.68    | 13.071  |
| 27.68999 | 13.423  |
| 27.69001 | 14.608  |
| 27.88999 | 14.866  |
| 27.89001 | 15.792  |
| 28.09    | 17.850  |
| 28.27999 | 17.959  |
| 28.29    | 21.780  |
| 28.49    | 25.387  |
| 28.49001 | 26.653  |
| 28.68999 | 27.922  |
| 28.69001 | 28.447  |
| 28.89001 | 29.471  |
| 29.08999 | 31.791  |
| 29.09    | 35.709  |
| 29.29    | 41.232  |
| 29.49    | 44.304  |
| 29.49001 | 44.469  |
| 29.68999 | 44.090  |
| 29.69001 | 46.626  |
| 29.88999 | 50.529  |
| 29.89001 | 54.785  |
| 30.08999 | 55.172  |
| 30.09    | 57.542  |
| 30.29    | 61.401  |
| 30.49    | 64.543  |
| 30.49001 | 65.996  |

Table 2.15-3. Percentage of time that 11.7 GHz isolation was less than the indicated value for February, 1978.

| IGTS     | PERCENT |
|----------|---------|
| 30.68999 | 67.455  |
| 30.69001 | 69.577  |
| 30.88999 | 70.541  |
| 30.89001 | 72.103  |
| 31.09    | 74.839  |
| 31.29    | 79.879  |
| 31.49    | 81.460  |
| 31.49001 | 81.991  |
| 31.68999 | 82.388  |
| 31.69001 | 83.074  |
| 31.88999 | 84.047  |
| 31.89001 | 84.762  |
| 32.09    | 86.753  |
| 32.29    | 87.960  |
| 32.49001 | 88.445  |
| 32.68999 | 90.812  |
| 32.69001 | 91.547  |
| 32.88999 | 91.691  |
| 32.89001 | 91.857  |
| 33.09    | 93.291  |
| 33.29    | 95.057  |
| 33.49    | 96.233  |
| 33.49001 | 96.405  |
| 33.69001 | 96.611  |
| 33.7     | 97.231  |
| 33.89001 | 97.575  |
| 34.08999 | 98.133  |
| 34.09    | 99.097  |
| 34.49999 | 99.158  |
| 34.68999 | 99.511  |
| 34.69001 | 99.735  |
| 34.88999 | 99.757  |
| 34.89001 | 99.968  |
| 35.09    | 99.981  |
| 35.69001 | 99.987  |
| 35.89001 | 100.000 |

Table 2.15-3 (continued). Percentage of time that 11.7 GHz isolation was less than the indicated value for February, 1978.

Table 2.15-4. Regression equations for the month of February, 1978.

| Relationship                                                   | 11.7 GHz                         |                |                | 19.04 GHz                        |                |                | 28.56 GHz                        |                |                |
|----------------------------------------------------------------|----------------------------------|----------------|----------------|----------------------------------|----------------|----------------|----------------------------------|----------------|----------------|
|                                                                | Equation                         | N <sub>s</sub> | R <sup>2</sup> | Equation                         | N <sub>s</sub> | R <sup>2</sup> | Equation                         | N <sub>s</sub> | R <sup>2</sup> |
| I on log <sub>10</sub> (A)<br>for 3 < A < 30                   | $I = 35.76 - 15.68 \log_{10}(A)$ | 2487           | .04<br>[1]     | $I = 19.59 - 27.01 \log_{10}(A)$ | 2516           | .13            | $I = 39.90 - 21.39 \log_{10}(A)$ | 4580           | .45            |
| A on R at equal<br>probability levels.                         | ID                               |                |                | ID                               |                |                | ID                               |                |                |
| Attenuation scaling.<br>A (11) at equal<br>probability levels. |                                  |                |                | $A(11) = .99^* A(19) 1.02$       | 3              | .99            | $A(11) = .77^* A(28) 1.08$       | 2              | .56            |
| Attenuation scaling.<br>A (19) at equal<br>probability levels. | $A(19) = 1.02^* A(11) .98$       | 3              | .99            |                                  |                |                | $A(19) = .66^* A(28) 1.12$       | 2              | .61            |
| Attenuation scaling.<br>A (28) at equal<br>probability levels. | $A(28) = 4.06^* A(11) .52$       | 2              | .56            | $A(28) = 3.78^* A(19) .55$       | 2              | .61            |                                  |                |                |

[1] Data were invalidated by spacecraft shutdowns during eclipse period

ID = insufficient data



2.16 March, 1978

See comments for January, 1978.

Table 2.16-1.

Key parameters for the month of March, 1978.

1. Rain Data

VPI&SU Accumulation, 78.58 mm (includes melted snow)

USWS Accumulation, 121.67 mm (279.4 mm of snow)

Peak VPI&SU Rate, 63 mm/hr

Percent of monthly accumulation at

R > 10 mm/hr, 5.59%      R > 20 mm/hr, 2.72%      R > 50 mm/hr, .67%

R > 30 mm/hr, 1.87%      R > 40 mm/hr, 1.11%

2. Signal Data

| Channel | Monthly Mean<br>Co Signal, dBm | Maximum Fade,<br>dB | Minimum Isolation<br>While in Phaselock, dB |
|---------|--------------------------------|---------------------|---------------------------------------------|
| 11.7    | -83.48                         | 50                  | 1.86(?) (21.29)*                            |
| 19.04V  | -88.37                         | 50                  | 7.71                                        |
| 19.04H  | -94.63                         | 50                  | -----                                       |
| 28.56   | -74.23                         | 50                  | 14.32                                       |

\* The first number is probably an artifact of the spacecraft off-on operations during the eclipse period.

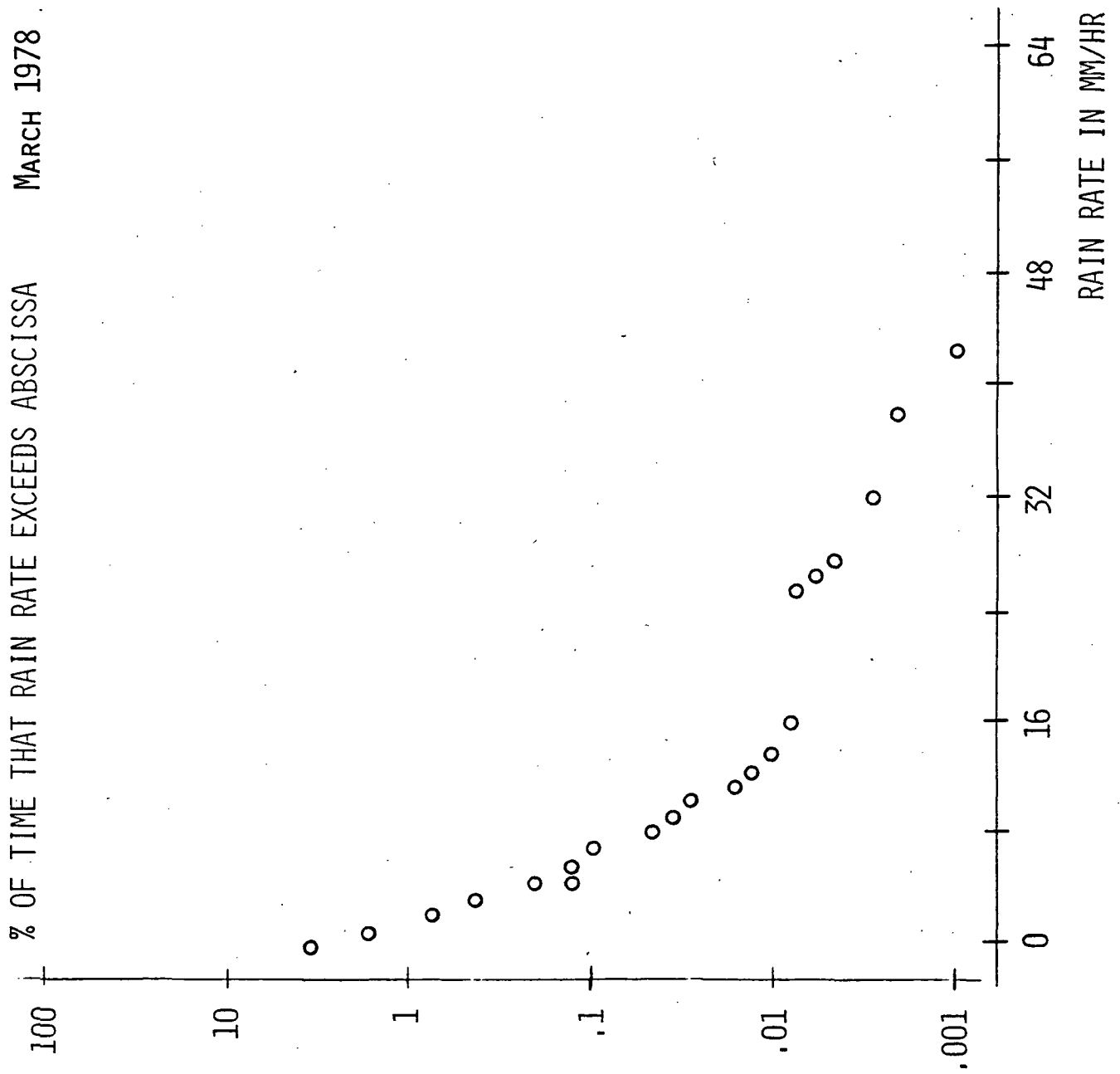


Figure 2.16-1. Rain rate statistics for March, 1978.

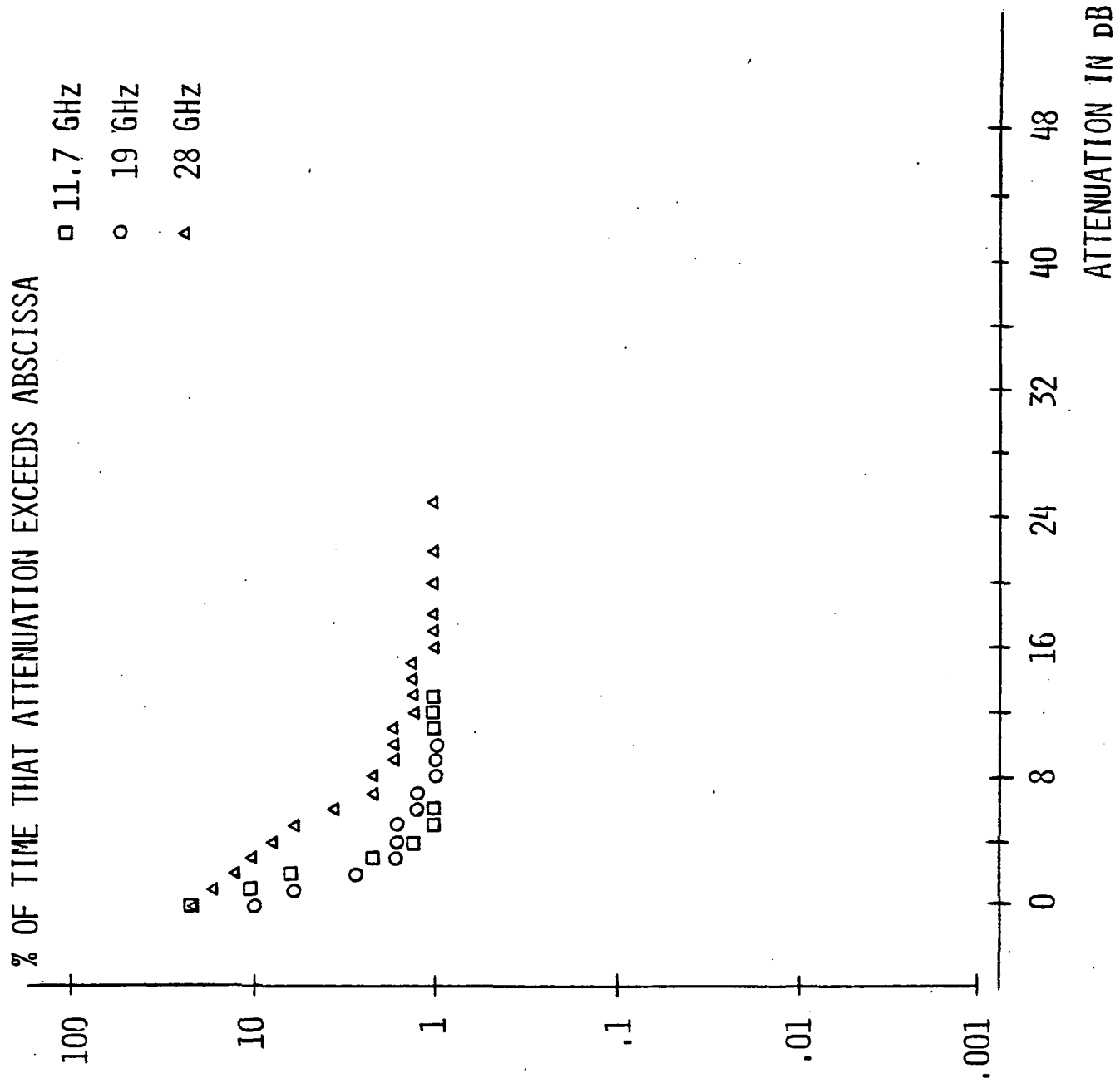


Figure 2.16-2. Attenuation statistics for March, 1978.

| RAIN | ACTS | AV19 | AC28 | PER    |
|------|------|------|------|--------|
| .    | .    | .    | 0    | 20.131 |
| .    | 0    | .    | .    | 19.507 |
| .    | .    | .    | 1    | 16.564 |
| .    | .    | .    | 2    | 13.224 |
| .    | .    | 0    | .    | 10.383 |
| .    | .    | .    | 3    | 9.530  |
| .    | 1    | .    | .    | 8.972  |
| .    | .    | .    | 4    | 7.185  |
| .    | 2    | .    | .    | 5.991  |
| .    | .    | .    | 5    | 5.718  |
| .    | .    | 1    | .    | 5.386  |
| 0    | .    | .    | 6    | 3.804  |
| .    | .    | .    | .    | 3.470  |
| .    | 3    | 2    | .    | 2.487  |
| .    | .    | .    | 7    | 2.429  |
| .    | .    | .    | 8    | 2.155  |
| .    | .    | 3    | .    | 1.906  |
| .    | .    | .    | 9    | 1.880  |
| .    | .    | 4    | .    | 1.763  |
| .    | .    | .    | 10   | 1.752  |
| 1    | .    | .    | .    | 1.712  |
| .    | .    | .    | 11   | 1.485  |
| .    | .    | 5    | .    | 1.475  |
| .    | .    | .    | 12   | 1.468  |
| .    | 4    | .    | .    | 1.451  |
| .    | .    | .    | 13   | 1.299  |
| .    | .    | 6    | .    | 1.180  |
| .    | .    | .    | 14   | 1.176  |
| .    | .    | .    | 15   | 1.149  |
| .    | .    | 7    | .    | 1.141  |
| .    | .    | .    | 16   | 1.140  |
| .    | .    | .    | 17   | 1.100  |
| .    | .    | 8    | .    | 1.094  |
| .    | .    | .    | 18   | 1.093  |
| .    | .    | 9    | .    | 1.092  |
| .    | 5    | .    | .    | 1.091  |
| .    | .    | 10   | 20   | 0.982  |
| .    | 6    | .    | .    | 0.962  |
| .    | 11   | .    | .    | 0.948  |
| .    | 12   | .    | .    | 0.947  |
| .    | .    | 11   | 22   | 0.934  |
| .    | 13   | 12   | 25   | 0.932  |
| 2    | .    | .    | .    | 0.930  |
| 3    | .    | .    | .    | 0.832  |
| 4    | .    | .    | .    | 0.487  |
| 5    | .    | .    | .    | 0.219  |
| 6    | .    | .    | .    | 0.129  |
| 7    | .    | .    | .    | 0.113  |
| 8    | .    | .    | .    | 0.090  |
| 9    | .    | .    | .    | 0.042  |
| 10   | .    | .    | .    | 0.034  |
| 11   | .    | .    | .    | 0.021  |
| 13   | .    | .    | .    | 0.015  |
| .    | .    | .    | .    | 0.012  |

Table 2.16-2. Attenuation and rain rate  
percent-of-time data for  
March, 1978.

| RAIN | ACTS | AV19 | AC28 | PER   |
|------|------|------|------|-------|
| 14   | .    | .    | .    | 0.010 |
| 16   | .    | .    | .    | 0.008 |
| 25   | .    | .    | .    | 0.007 |
| 26   | .    | .    | .    | 0.006 |
| 28   | .    | .    | .    | 0.004 |
| 32   | .    | .    | .    | 0.003 |
| 38   | .    | .    | .    | 0.002 |
| 42   | .    | .    | .    | 0.001 |
| 63   | 50   | 50   | 50   | 0.000 |

Table 2.16-2 (continued). Attenuation and rain rate percent-of-time data for March, 1978.

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| ICTS     | PERCENT |
|----------|---------|
| 1.860007 | 0.002   |
| 2.460013 | 0.003   |
| 21.29    | 0.032   |
| 21.88999 | 0.059   |
| 22.09    | 0.113   |
| 22.49    | 0.116   |
| 22.68999 | 0.243   |
| 22.89001 | 0.263   |
| 23.29    | 0.718   |
| 23.49    | 0.984   |
| 23.69001 | 1.004   |
| 24.09    | 1.318   |
| 24.29    | 1.839   |
| 24.49    | 1.854   |
| 24.49001 | 1.903   |
| 24.88999 | 2.069   |
| 24.89001 | 2.206   |
| 25.09    | 2.718   |
| 25.29    | 3.196   |
| 25.49    | 3.358   |
| 25.49001 | 3.444   |
| 25.68999 | 3.698   |
| 25.69001 | 4.146   |
| 25.88999 | 4.225   |
| 25.89001 | 4.422   |
| 26.08999 | 4.822   |
| 26.09    | 5.477   |
| 26.29    | 6.057   |
| 26.49    | 7.188   |
| 26.68999 | 7.528   |
| 26.69001 | 7.547   |
| 26.88999 | 8.799   |
| 26.89001 | 9.355   |
| 27.08999 | 9.586   |
| 27.29    | 11.099  |
| 27.49    | 11.941  |
| 27.49001 | 12.069  |
| 27.68999 | 13.957  |
| 27.69001 | 14.354  |
| 27.88999 | 14.818  |
| 27.89001 | 15.011  |
| 28.08999 | 15.231  |
| 28.09    | 15.597  |
| 28.29    | 17.137  |
| 28.49    | 19.287  |
| 28.49001 | 20.289  |
| 28.68999 | 20.611  |
| 28.69001 | 22.301  |
| 28.88999 | 22.639  |
| 28.89001 | 23.532  |
| 29.08999 | 23.793  |
| 29.09    | 29.003  |
| 29.29    | 32.204  |

Table 2.16-3. Percentage of time that 11.7 GHz isolation was less than the indicated value for March, 1978.

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| ICIS     | PERCENT |
|----------|---------|
| 29.49    | 32.682  |
| 29.49001 | 32.906  |
| 29.68999 | 33.740  |
| 29.69001 | 34.421  |
| 29.88999 | 35.790  |
| 29.89001 | 40.043  |
| 30.08999 | 41.379  |
| 30.09    | 44.000  |
| 30.29    | 46.084  |
| 30.49    | 48.013  |
| 30.49001 | 48.324  |
| 30.68999 | 50.817  |
| 30.69001 | 53.043  |
| 30.88999 | 54.124  |
| 30.89001 | 57.174  |
| 31.08999 | 57.529  |
| 31.09    | 59.694  |
| 31.29    | 61.764  |
| 31.49    | 63.605  |
| 31.49001 | 63.611  |
| 31.68999 | 64.690  |
| 31.69001 | 67.448  |
| 31.88999 | 70.248  |
| 31.89001 | 72.614  |
| 32.08999 | 72.622  |
| 32.09    | 73.586  |
| 32.29    | 75.263  |
| 32.49    | 77.323  |
| 32.49001 | 78.297  |
| 32.68999 | 79.535  |
| 32.69001 | 81.735  |
| 32.7     | 81.735  |
| 32.88999 | 81.893  |
| 32.89001 | 82.014  |
| 33.08999 | 82.097  |
| 33.09    | 84.312  |
| 33.29    | 86.374  |
| 33.49    | 87.795  |
| 33.49001 | 87.939  |
| 33.50001 | 87.949  |
| 33.68999 | 88.140  |
| 33.69001 | 88.462  |
| 33.88999 | 88.961  |
| 33.89001 | 89.981  |
| 34.08999 | 90.005  |
| 34.09    | 91.239  |
| 34.29    | 92.241  |
| 34.49    | 92.636  |
| 34.49001 | 92.725  |
| 34.50001 | 92.729  |
| 34.68999 | 92.752  |
| 34.69001 | 92.950  |
| 34.88999 | 92.977  |
| 34.89001 | 93.178  |
| 35.08999 | 93.180  |

Table 2.16-3 (continued). Percentage of time that 11.7 GHz isolation was less than the indicated value for March, 1978.



Table 2.16-4. Regression equations for the month of March, 1978.

| Relationship                                             | 11.7 GHz                               |                |                | 19.04 GHz                             |                |                | 28.56 GHz                              |                |                |
|----------------------------------------------------------|----------------------------------------|----------------|----------------|---------------------------------------|----------------|----------------|----------------------------------------|----------------|----------------|
|                                                          | Equation                               | N <sub>S</sub> | R <sup>2</sup> | Equation                              | N <sub>S</sub> | R <sup>2</sup> | Equation                               | N <sub>S</sub> | R <sup>2</sup> |
| I on log <sub>10</sub> (A) for 3 < A < 30                | $I = \frac{33.67}{14.37} \log_{10}(A)$ | 3155           | .36            | $I = \frac{27.68}{4.62} \log_{10}(A)$ | 258            | .04            | $I = \frac{41.59}{26.80} \log_{10}(A)$ | 10356          | .54            |
| A on R at equal probability levels.                      | ID                                     |                |                | ID                                    |                |                | ID                                     |                |                |
| Attenuation scaling. A (11) at equal probability levels. |                                        |                |                | ID                                    |                |                |                                        |                |                |
| Attenuation scaling. A (19) at equal probability levels. | ID                                     |                |                |                                       |                |                | $A(19) = .04^*$<br>$A(28) = 1.82$      | 3              | 1.0            |
| Attenuation scaling. A (28) at equal probability levels. | ID                                     |                |                | $A(28) = 6.08^*$<br>$A(19) = .54$     | 3              | .98            |                                        |                |                |

[1] A local oscillator malfunction hampered accurate data collection

ID = insufficient data

### 3. LONG-TERM STATISTICS

#### 3.1 Introduction

Chapter 2 summarized the available data for each month of the report period. In this chapter we present preliminary composite statistics for periods ranging from three to eleven months.

Long-term attenuation and rain statistics are valuable for deriving relationships between attenuation and rain rate and for predicting the long-term performance of satellite communications systems. In the first case it is important that the data base contain only fades due to rain that was recorded by the rain gauges (i.e. data taken during snow, sleet, and rain that fell when the gauges were frozen must be excluded). In our climate this means that data from the months of January, February, and March must be excluded when a comparison of attenuation and rain rate statistics is made.

Predicting link performance, on the other hand, required a statistical data base that includes all fades produced by the propagation medium, whether or not these were associated with measurable precipitation on the ground. Fades due to equipment failure and unplanned satellite motions must be excluded unless these occurred for insignificant periods of time. This has been a particular problem with CTS where satellite maneuvers and beacon shut downs have occurred regularly.

In the pages which follow we present statistics for two long periods (10 or 11 months) and for several shorter periods (3 to 5 months). These are organized as follows.

### 3.2 Calendar Year 1977 less February

In this data base values for 19 and 28 GHz attenuation were scaled from those measured at 11.7 GHz (See Chapter 2.) for the months before which the COMSTAR system became operational. The 11.7 GHz data for December, 1977, were biased by spacecraft maneuvers. Since a significant number of sleet and snow fades are included in these data (and much of the 19 and 28 GHz data were scaled), tables of regression equations are not included.

### 3.3 June, 1977, through March, 1978

This section contains data collected for the period beginning with the activation of both COMSTAR systems. It includes the CTS maneuvers and some periods of 19 GHz local oscillator malfunction. However the 28 GHz data were valid for the entire period and the resulting statistics include the effect of some real snow and sleet fades at this frequency.

### 3.4 July, August, and September, 1977

This quarter contains rain data for all three frequencies and provided the data base for the theoretical work in the accompanying volume. (See Chapter 1.)

### 3.5 October, November, and December, 1977

All 28 GHz data here are good; the 19 GHz system had local oscillator problems in November and CTS maneuvers biased the 11.7 GHz data in December. For these reasons regression equations are not included.

3.6 January, February, and March, 1978

Data for this quarter reflect the influence of snow and sleet which our rain gauges were unable to record.

3.7 July through November, 1977

This is a period of excellent rain data for the 11.7 and 28 GHz systems and the regression equations represent our largest rain-effects data base at these frequencies.

3.8 July through October and December, 1977

This period was selected to exclude the 19 GHz local oscillator failure. It represents our largest data base for 19 GHz rain attenuation.

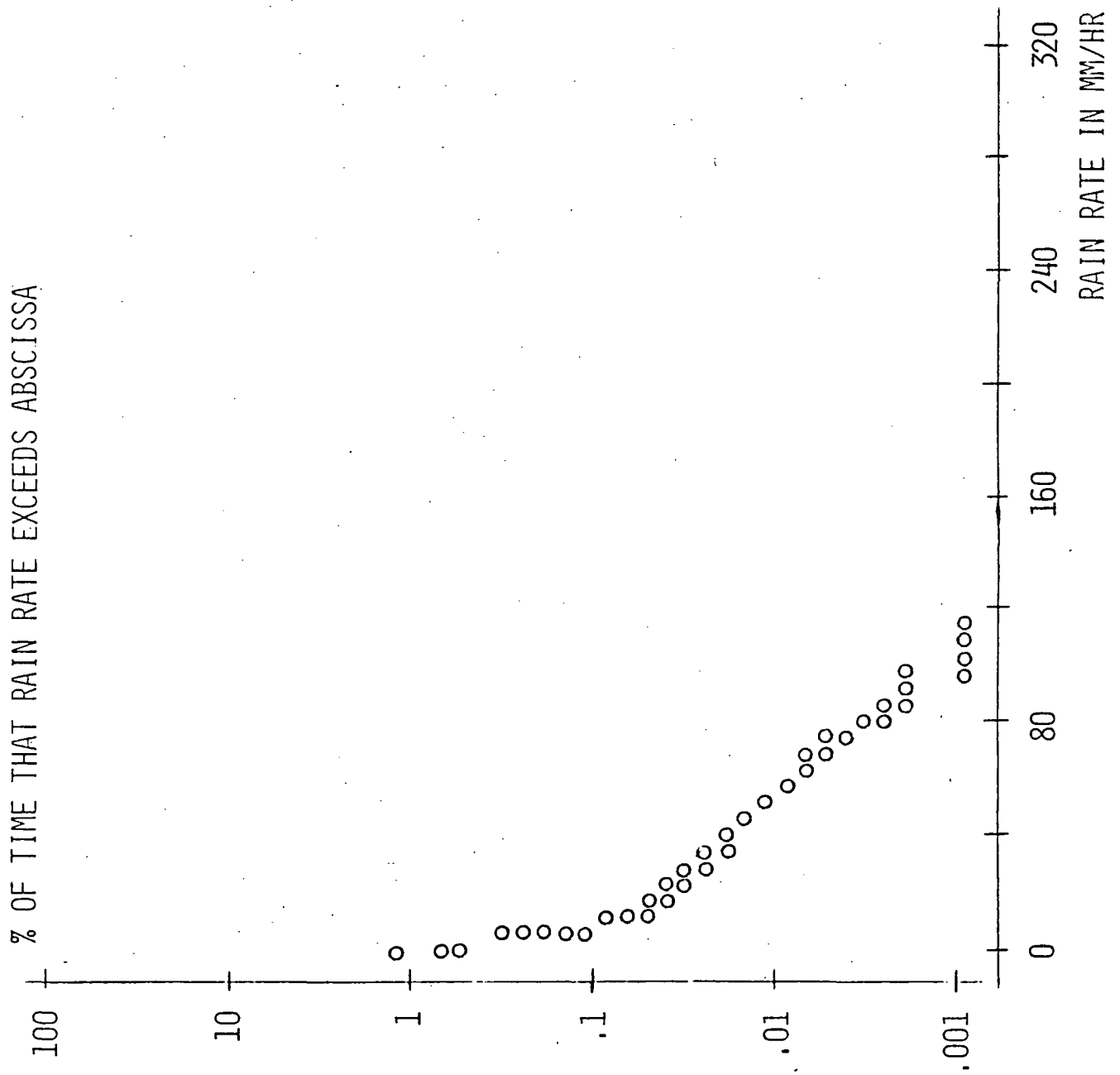


Figure 3.2-1. Rain rate statistics for the calendar year 1977 less February.

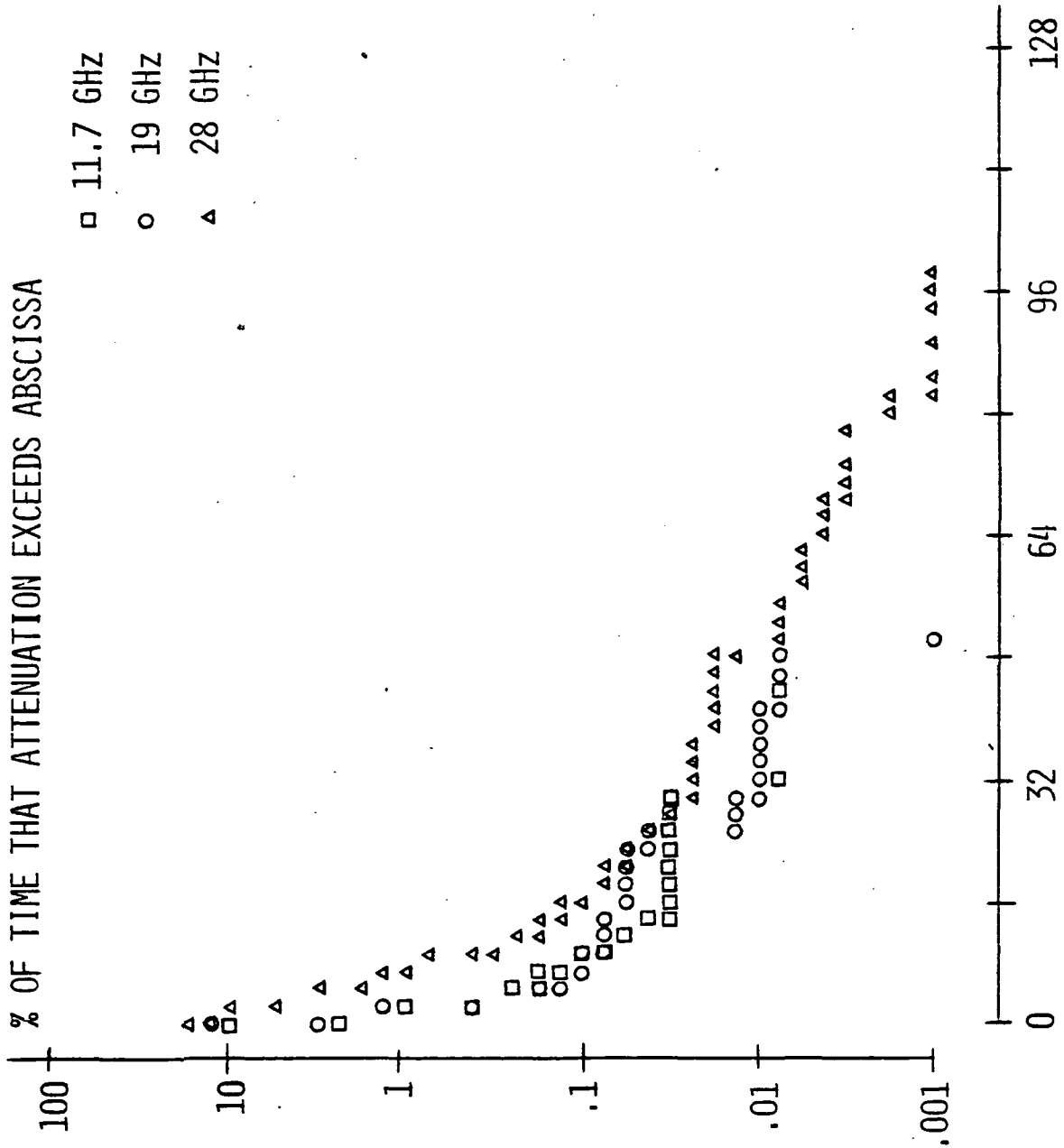


Figure 3.2-2. Attenuation statistics for the calendary year 1977 less February.

| RAIN | ACTS | AV19 | AC28 | PER    |
|------|------|------|------|--------|
| .    | .    | 0    | 0    | 20.160 |
| .    | .    | .    | 1    | 13.297 |
| .    | 0    | .    | 2    | 12.934 |
| .    | .    | .    | 3    | 10.435 |
| .    | .    | .    | 4    | 9.327  |
| .    | .    | 1    | 5    | 5.972  |
| .    | .    | .    | 6    | 3.619  |
| .    | 1    | .    | 7    | 2.963  |
| .    | .    | .    | 8    | 2.618  |
| 0    | .    | .    | 9    | 1.982  |
| .    | .    | .    | 10   | 1.507  |
| .    | .    | 2    | 11   | 1.265  |
| .    | .    | .    | 12   | 1.193  |
| 1    | .    | .    | 13   | 0.948  |
| .    | 2    | .    | 14   | 0.951  |
| .    | .    | .    | 15   | 0.893  |
| 2    | .    | .    | 16   | 0.684  |
| .    | .    | .    | 17   | 0.637  |
| 3    | .    | .    | 18   | 0.460  |
| .    | 3    | .    | 19   | 0.450  |
| .    | .    | 3    | .    | 0.447  |
| 4    | .    | .    | 10   | 0.429  |
| .    | .    | .    | 11   | 0.523  |
| 5    | .    | .    | 12   | 0.252  |
| .    | 4    | .    | 13   | 0.247  |
| 6    | .    | 4    | 14   | 0.223  |
| .    | .    | .    | 15   | 0.205  |
| 7    | 5    | .    | 16   | 0.200  |
| .    | .    | .    | 17   | 0.191  |
| 8    | 6    | .    | 18   | 0.164  |
| .    | .    | .    | 19   | 0.163  |
| 9    | .    | .    | .    | 0.161  |
| .    | 7    | .    | 10   | 0.140  |
| 10   | .    | .    | 11   | 0.134  |
| .    | .    | 5    | 12   | 0.133  |
| 11   | .    | .    | 13   | 0.131  |
| .    | .    | 6    | 14   | 0.117  |
| 12   | 8    | 7    | 15   | 0.114  |
| .    | .    | .    | 16   | 0.104  |
| 13   | .    | 8    | 17   | 0.102  |
| .    | 9    | .    | 18   | 0.099  |
| 14   | .    | 9    | 19   | 0.096  |
| .    | .    | .    | .    | 0.093  |
| 10   | 10   | 10   | .    | 0.090  |
| .    | .    | .    | 17   | 0.089  |
| 11   | .    | .    | 18   | 0.088  |
| .    | .    | 11   | 19   | 0.086  |
| 12   | .    | .    | .    | 0.084  |
| .    | .    | 12   | .    | 0.080  |
| 13   | .    | .    | .    | 0.079  |
| .    | .    | .    | .    | 0.078  |
| 14   | .    | .    | .    | 0.075  |
| .    | .    | .    | .    | 0.072  |
| .    | 10   | .    | .    | 0.070  |

Table 3.2-1. Attenuation and rain rate  
percent-of-time data for  
the calendar year 1977  
less February.

| RAIN | ACTS | AV19 | AC28 | PER   |
|------|------|------|------|-------|
| .    | .    | 13   | 20   | 0.069 |
| 15   | .    | .    | .    | 0.068 |
| .    | .    | 14   | .    | 0.065 |
| .    | .    | .    | 21   | 0.063 |
| .    | 11   | .    | .    | 0.062 |
| 16   | .    | 15   | .    | 0.061 |
| 17   | .    | .    | .    | 0.058 |
| .    | .    | 16   | .    | 0.057 |
| .    | .    | .    | 22   | 0.056 |
| 18   | .    | 17   | .    | 0.055 |
| .    | 12   | 18   | .    | 0.053 |
| 19   | .    | 19   | .    | 0.052 |
| .    | .    | 20   | .    | 0.051 |
| .    | .    | 21   | 23   | 0.050 |
| 20   | .    | 22   | .    | 0.049 |
| .    | .    | 23   | .    | 0.048 |
| 21   | .    | .    | .    | 0.046 |
| .    | .    | .    | 24   | 0.045 |
| 22   | .    | .    | .    | 0.044 |
| 23   | .    | .    | .    | 0.042 |
| .    | .    | .    | 25   | 0.041 |
| 24   | .    | .    | .    | 0.040 |
| .    | 13   | .    | .    | 0.039 |
| 25   | .    | .    | .    | 0.038 |
| .    | .    | 24   | 26   | 0.037 |
| 26   | 14   | .    | .    | 0.036 |
| 27   | 15   | .    | .    | 0.035 |
| 28   | .    | .    | .    | 0.034 |
| .    | 16   | .    | .    | 0.033 |
| .    | 17   | .    | .    | 0.033 |
| 29   | 18   | .    | .    | 0.032 |
| 30   | 19   | .    | 27   | 0.031 |
| 31   | 20   | .    | .    | 0.030 |
| 31   | 21   | .    | .    | 0.030 |
| 31   | 22   | .    | .    | 0.030 |
| 31   | 23   | .    | .    | 0.030 |
| 32   | 24   | .    | 28   | 0.029 |
| 32   | 25   | .    | 28   | 0.029 |
| 32   | 26   | .    | 28   | 0.029 |
| 33   | 27   | .    | .    | 0.028 |
| 33   | 28   | .    | .    | 0.028 |
| 33   | 30   | .    | .    | 0.028 |
| 34   | .    | .    | .    | 0.027 |
| 35   | .    | .    | 29   | 0.026 |
| 36   | .    | .    | 30   | 0.025 |
| 37   | .    | .    | 31   | 0.024 |
| 37   | .    | .    | 32   | 0.024 |
| 38   | .    | .    | 33   | 0.023 |
| 39   | .    | .    | 34   | 0.022 |
| 40   | .    | .    | 35   | 0.021 |
| 40   | .    | .    | 36   | 0.021 |
| 40   | .    | .    | 37   | 0.021 |
| 41   | .    | .    | 38   | 0.020 |
| 42   | .    | .    | 39   | 0.020 |

Table 3.2-1 (continued). Attenuation and rain rate percent-of-time data for the calendar year 1977 less February.



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| RAIN | ACTS | AV19 | AC28 | PER   |
|------|------|------|------|-------|
| 42   | .    | .    | 40   | 0.020 |
| 43   | .    | .    | 41   | 0.019 |
| 43   | .    | .    | 42   | 0.019 |
| 44   | .    | .    | 43   | 0.018 |
| 44   | .    | .    | 44   | 0.018 |
| 45   | .    | .    | 45   | 0.017 |
| 45   | .    | .    | 46   | 0.017 |
| 46   | .    | .    | 47   | 0.016 |
| 47   | .    | .    | 48   | 0.016 |
| 48   | .    | .    | 49   | 0.015 |
| 49   | .    | 25   | .    | 0.014 |
| 50   | .    | 26   | .    | 0.014 |
| 51   | .    | 27   | .    | 0.014 |
| 52   | .    | 28   | .    | 0.013 |
| 53   | .    | 28   | .    | 0.013 |
| 54   | .    | 29   | .    | 0.012 |
| 55   | .    | 29   | .    | 0.012 |
| 56   | .    | 29   | .    | 0.012 |
| 57   | .    | 30   | .    | 0.011 |
| 57   | .    | 31   | .    | 0.011 |
| 57   | .    | 32   | .    | 0.011 |
| 58   | .    | 33   | .    | 0.011 |
| 59   | .    | 34   | .    | 0.010 |
| 59   | .    | 35   | .    | 0.010 |
| 59   | .    | 36   | .    | 0.010 |
| 60   | .    | 37   | .    | 0.010 |
| 60   | .    | 38   | .    | 0.009 |
| 60   | .    | 39   | .    | 0.009 |
| 61   | 33   | 40   | .    | 0.009 |
| 62   | 33   | 41   | 50   | 0.008 |
| 63   | 33   | 42   | 51   | 0.008 |
| 64   | 33   | 45   | 51   | 0.008 |
| 64   | 33   | 46   | 51   | 0.008 |
| 65   | 43   | 48   | 51   | 0.008 |
| 66   | 43   | 49   | 53   | 0.007 |
| 69   | 43   | 49   | 54   | 0.007 |
| 70   | 43   | 49   | 54   | 0.007 |
| 71   | .    | .    | 54   | 0.007 |
| 72   | .    | .    | 56   | 0.006 |
| 74   | .    | .    | 57   | 0.006 |
| 75   | .    | .    | 57   | 0.006 |
| 76   | .    | .    | 58   | 0.005 |
| 77   | .    | .    | 60   | 0.005 |
| 78   | .    | .    | 61   | 0.005 |
| 79   | .    | .    | 61   | 0.005 |
| 80   | .    | .    | 61   | 0.005 |
| 81   | .    | .    | 63   | 0.004 |
| 83   | .    | .    | 64   | 0.004 |
| 84   | .    | .    | 65   | 0.004 |
| 84   | .    | .    | 66   | 0.004 |
| 84   | .    | .    | 67   | 0.004 |
| 85   | .    | .    | 68   | 0.004 |
| 86   | .    | .    | 69   | 0.003 |
| 87   | .    | .    | 70   | 0.003 |
|      | .    | .    | 72   | 0.003 |

Table 3.2-1 (continued). Attenuation and rain rate percent-of-time data for the calendar year 1977 less February.

| RAIN | ACTS | AV19 | AC28 | PER   |
|------|------|------|------|-------|
| 88   | .    | .    | 73   | 0.003 |
| 88   | .    | .    | 74   | 0.003 |
| 88   | .    | .    | 77   | 0.003 |
| 89   | .    | .    | 79   | 0.002 |
| 90   | .    | .    | 80   | 0.002 |
| 91   | .    | .    | 82   | 0.002 |
| 92   | .    | .    | 82   | 0.002 |
| 93   | .    | .    | 82   | 0.002 |
| 97   | .    | .    | 82   | 0.002 |
| 100  | .    | .    | 82   | 0.002 |
| 102  | .    | 50   | 83   | 0.001 |
| 103  | .    | 50   | 85   | 0.001 |
| 105  | .    | 50   | 90   | 0.001 |
| 106  | .    | 50   | 93   | 0.001 |
| 112  | .    | 50   | 97   | 0.001 |
| 113  | .    | 50   | 99   | 0.001 |
| 121  | 50   | 51   | 102  | 0.000 |
| 136  | 50   | 52   | 105  | 0.000 |
| 155  | 50   | 54   | 108  | 0.000 |
| 198  | 50   | 57   | 114  | 0.000 |
| 201  | 50   | 60   | 120  | 0.000 |

Table 3.2-1 (continued). Attenuation and rain rate percent-of-time data for the calendar year 1977 less February.

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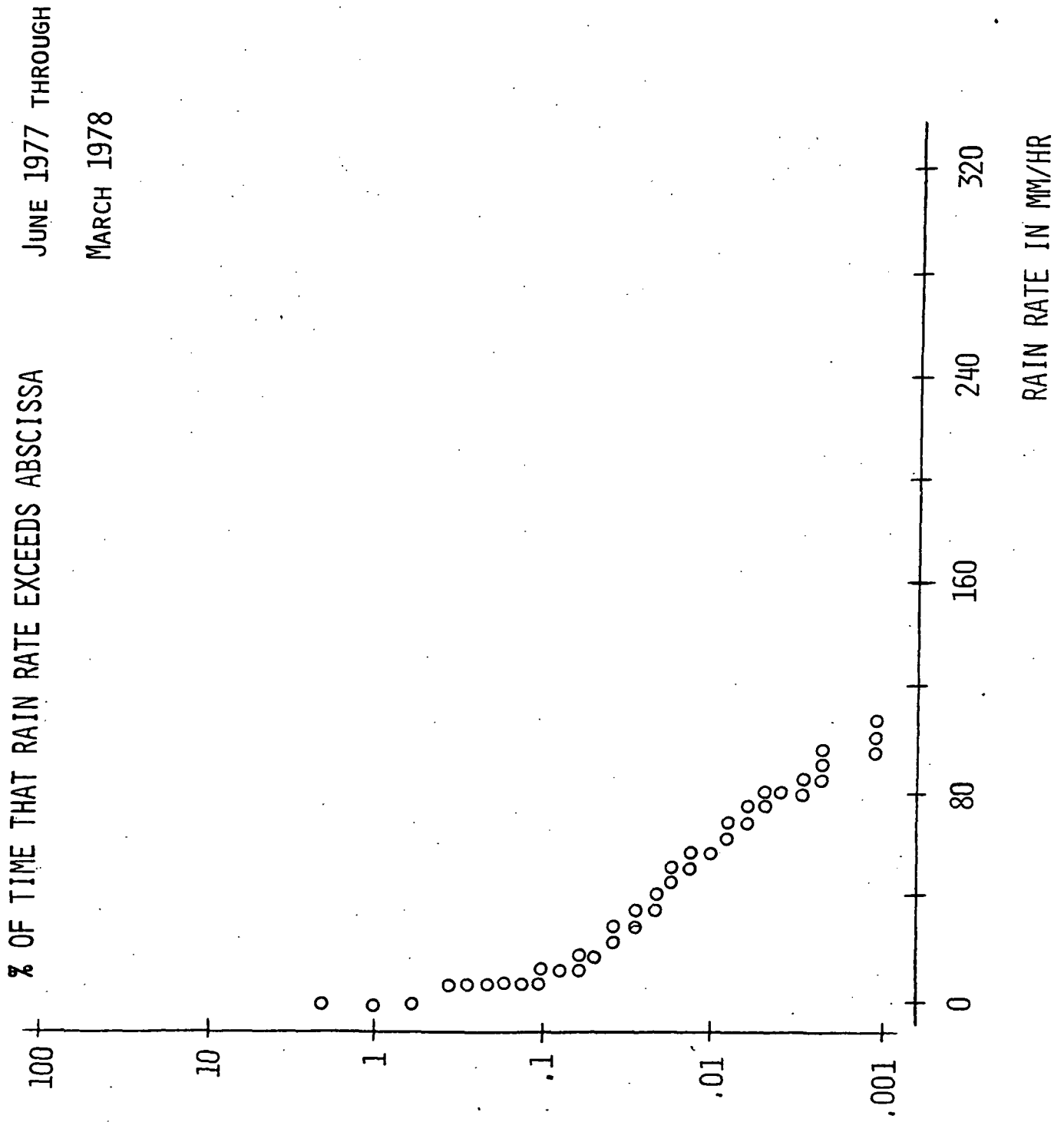


Figure 3.3-1. Rain rate statistics for June 1977 through March 1978.

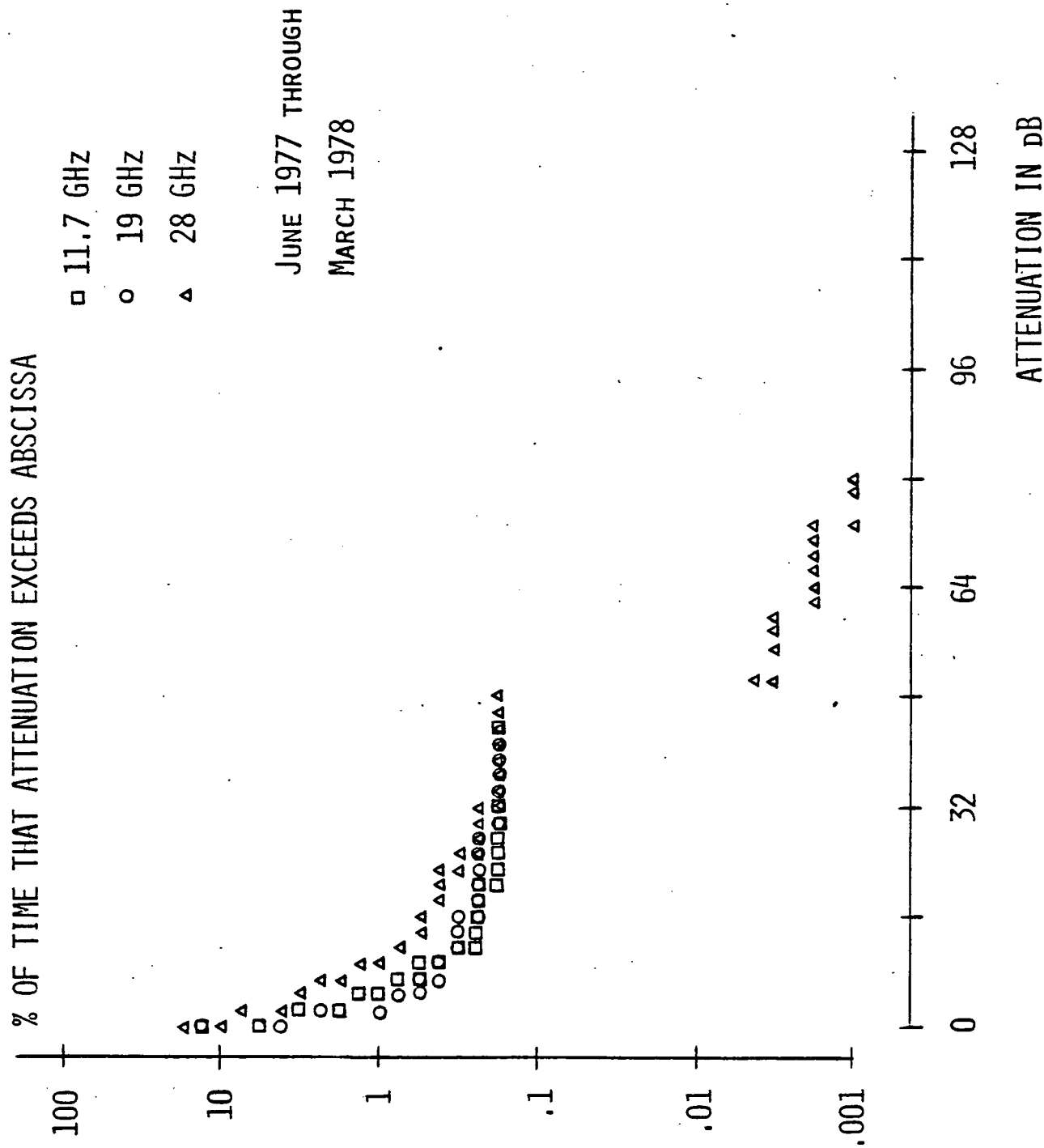


Figure 3.3-2. Attenuation statistics for June 1977 through March 1978.

| RAIN | ACTS | AV19 | AC28 | PER    |
|------|------|------|------|--------|
| .    | .    | 0    | 0    | 16.360 |
| .    | 0    | .    | .    | 13.455 |
| .    | .    | .    | 1    | 13.349 |
| .    | .    | .    | 2    | 9.206  |
| .    | 1    | .    | 3    | 6.698  |
| .    | .    | 1    | 4    | 5.620  |
| .    | .    | .    | 5    | 4.814  |
| .    | 2    | .    | 6    | 4.441  |
| .    | .    | .    | 7    | 3.639  |
| .    | .    | .    | 8    | 2.941  |
| .    | 3    | .    | 9    | 2.916  |
| .    | .    | 2    | 10   | 2.221  |
| 0    | .    | .    | 11   | 2.066  |
| .    | 3    | .    | 12   | 1.889  |
| .    | .    | .    | 13   | 1.689  |
| .    | 4    | .    | 14   | 1.688  |
| .    | .    | .    | 15   | 1.356  |
| .    | .    | 3    | 16   | 1.176  |
| .    | .    | .    | 17   | 1.152  |
| 1    | .    | .    | 18   | 1.106  |
| .    | 5    | .    | 19   | 0.951  |
| .    | .    | .    | 20   | 0.922  |
| .    | 6    | .    | 21   | 0.897  |
| .    | .    | .    | 22   | 0.784  |
| .    | .    | .    | 23   | 0.780  |
| .    | .    | 4    | 24   | 0.701  |
| .    | 7    | .    | 25   | 0.668  |
| 2    | .    | .    | 26   | 0.617  |
| .    | .    | 5    | 27   | 0.611  |
| .    | 8    | .    | 28   | 0.569  |
| .    | .    | .    | 29   | 0.585  |
| .    | .    | .    | 30   | 0.546  |
| .    | 9    | .    | 31   | 0.528  |
| .    | .    | .    | 32   | 0.513  |
| .    | .    | 6    | 33   | 0.495  |
| .    | .    | .    | 34   | 0.489  |
| .    | .    | 7    | 35   | 0.489  |
| .    | 10   | .    | 36   | 0.476  |
| .    | .    | .    | 37   | 0.461  |
| .    | .    | 8    | 38   | 0.439  |
| .    | .    | .    | 39   | 0.433  |
| .    | .    | 9    | 40   | 0.428  |
| 3    | .    | .    | 41   | 0.421  |
| .    | .    | 10   | 42   | 0.412  |
| .    | .    | .    | 43   | 0.412  |
| .    | 11   | .    | 44   | 0.405  |
| .    | .    | 11   | 45   | 0.387  |
| .    | .    | .    | 46   | 0.376  |
| .    | .    | 12   | 47   | 0.374  |
| .    | .    | .    | 48   | 0.351  |
| .    | .    | 13   | 49   | 0.346  |
| .    | .    | .    | 50   | 0.346  |
| .    | .    | 14   | 51   | 0.329  |
| .    | .    | .    | 52   | 0.324  |
| .    | .    | .    | 53   | 0.324  |
| .    | .    | .    | 54   | 0.319  |
| .    | .    | .    | 55   | 0.312  |
| .    | .    | .    | 56   | 0.298  |

Table 3.3-1. Attenuation and rain rate  
percent-of-time data for  
June 1977 through March 1978.

| RAIN | ACTS | AV19 | AC28 | PER   |
|------|------|------|------|-------|
| .    | .    | .    | 25   | 0.289 |
| .    | .    | 15   | .    | 0.283 |
| .    | .    | 16   | .    | 0.275 |
| .    | .    | 17   | 26   | 0.270 |
| .    | .    | 18   | .    | 0.267 |
| .    | .    | 19   | .    | 0.266 |
| 4    | .    | 20   | .    | 0.265 |
| .    | .    | 21   | .    | 0.264 |
| .    | .    | 22   | .    | 0.262 |
| .    | .    | 23   | .    | 0.261 |
| .    | .    | .    | 27   | 0.252 |
| .    | .    | 24   | .    | 0.247 |
| .    | .    | .    | 28   | 0.242 |
| .    | 12   | .    | .    | 0.226 |
| .    | .    | .    | 29   | 0.224 |
| .    | .    | 25   | .    | 0.222 |
| .    | .    | 26   | .    | 0.221 |
| .    | .    | 27   | .    | 0.221 |
| .    | .    | .    | 30   | 0.219 |
| .    | 13   | 28   | .    | 0.212 |
| .    | 14   | .    | .    | 0.210 |
| .    | 15   | .    | .    | 0.209 |
| .    | 16   | .    | 31   | 0.208 |
| .    | 17   | .    | .    | 0.207 |
| .    | 18   | .    | .    | 0.207 |
| .    | 19   | .    | 32   | 0.206 |
| .    | 20   | .    | 32   | 0.206 |
| .    | 21   | .    | .    | 0.205 |
| .    | 23   | .    | .    | 0.205 |
| .    | 24   | .    | .    | 0.205 |
| .    | 25   | .    | .    | 0.205 |
| .    | 27   | .    | .    | 0.204 |
| .    | 28   | .    | .    | 0.204 |
| 5    | 30   | .    | .    | 0.204 |
| .    | .    | .    | .    | 0.201 |
| .    | .    | .    | 33   | 0.199 |
| .    | .    | .    | 34   | 0.196 |
| .    | .    | .    | 35   | 0.195 |
| .    | .    | 29   | 36   | 0.193 |
| .    | .    | 29   | 37   | 0.193 |
| .    | .    | 29   | 38   | 0.193 |
| .    | .    | .    | 39   | 0.192 |
| .    | .    | .    | 40   | 0.192 |
| .    | .    | .    | 41   | 0.192 |
| .    | .    | .    | 42   | 0.191 |
| .    | .    | .    | 43   | 0.191 |
| .    | .    | .    | 44   | 0.191 |
| .    | .    | .    | 45   | 0.190 |
| .    | .    | .    | 47   | 0.189 |
| .    | .    | 30   | .    | 0.188 |
| .    | .    | .    | 48   | 0.185 |
| .    | .    | .    | 49   | 0.185 |
| .    | .    | 31   | .    | 0.184 |
| .    | 33   | 32   | .    | 0.183 |

Table 3.3-1 (continued). Attenuation and rain rate percent-of-time data for June 1977 through March 1978.

| RAIN | ACTS | AV19 | AC28 | PER   |
|------|------|------|------|-------|
| .    | 33   | 33   | .    | 0.183 |
| .    | 33   | 34   | .    | 0.183 |
| .    | 33   | 35   | .    | 0.183 |
| .    | 33   | 36   | .    | 0.183 |
| .    | .    | 37   | .    | 0.182 |
| .    | .    | 38   | .    | 0.182 |
| .    | .    | 39   | .    | 0.182 |
| .    | .    | 40   | .    | 0.182 |
| .    | 43   | 41   | .    | 0.181 |
| 6    | .    | .    | .    | 0.163 |
| 7    | .    | .    | .    | 0.132 |
| 8    | .    | .    | .    | 0.104 |
| 9    | .    | .    | .    | 0.093 |
| 10   | .    | .    | .    | 0.082 |
| 11   | .    | .    | .    | 0.074 |
| 12   | .    | .    | .    | 0.069 |
| 13   | .    | .    | .    | 0.063 |
| 14   | .    | .    | .    | 0.059 |
| 15   | .    | .    | .    | 0.055 |
| 16   | .    | .    | .    | 0.050 |
| 17   | .    | .    | .    | 0.047 |
| 18   | .    | .    | .    | 0.045 |
| 19   | .    | .    | .    | 0.043 |
| 20   | .    | .    | .    | 0.041 |
| 21   | .    | .    | .    | 0.039 |
| 22   | .    | .    | .    | 0.037 |
| 23   | .    | .    | .    | 0.035 |
| 24   | .    | .    | .    | 0.034 |
| 25   | .    | .    | .    | 0.032 |
| 26   | .    | .    | .    | 0.031 |
| 27   | .    | .    | .    | 0.030 |
| 28   | .    | .    | .    | 0.029 |
| 29   | .    | .    | .    | 0.028 |
| 30   | .    | .    | .    | 0.027 |
| 31   | .    | .    | .    | 0.026 |
| 32   | .    | .    | .    | 0.025 |
| 33   | .    | .    | .    | 0.025 |
| 34   | .    | .    | .    | 0.024 |
| 35   | .    | .    | .    | 0.024 |
| 36   | .    | .    | .    | 0.023 |
| 37   | .    | .    | .    | 0.022 |
| 38   | .    | .    | .    | 0.021 |
| 39   | .    | .    | .    | 0.020 |
| 40   | .    | .    | .    | 0.020 |
| 41   | .    | .    | .    | 0.019 |
| 42   | .    | .    | .    | 0.018 |
| 43   | .    | .    | .    | 0.017 |
| 44   | .    | .    | .    | 0.017 |
| 45   | .    | .    | .    | 0.016 |
| 46   | .    | .    | .    | 0.015 |
| 47   | .    | .    | .    | 0.015 |
| 48   | .    | .    | .    | 0.015 |
| 49   | .    | .    | .    | 0.014 |
| 50   | .    | .    | .    | 0.014 |

Table 3.3-1 (continued). Attenuation and rain rate  
percent-of-time data for  
June 1977 through March 1978.

| RAIN | ACTS | AV19 | AC28 | PER   |
|------|------|------|------|-------|
| 51   | .    | .    | .    | 0.013 |
| 52   | .    | .    | .    | 0.013 |
| 53   | .    | .    | .    | 0.012 |
| 54   | .    | .    | .    | 0.012 |
| 55   | .    | .    | .    | 0.012 |
| 56   | .    | .    | .    | 0.011 |
| 57   | .    | .    | .    | 0.011 |
| 58   | .    | .    | .    | 0.010 |
| 59   | .    | .    | .    | 0.010 |
| 60   | .    | .    | .    | 0.009 |
| 61   | .    | .    | .    | 0.008 |
| 62   | .    | .    | .    | 0.008 |
| 63   | .    | .    | .    | 0.008 |
| 64   | .    | .    | .    | 0.008 |
| 65   | .    | .    | .    | 0.007 |
| 66   | .    | .    | .    | 0.007 |
| 69   | .    | .    | .    | 0.007 |
| 70   | .    | .    | .    | 0.007 |
| 71   | .    | .    | .    | 0.006 |
| 72   | .    | .    | .    | 0.006 |
| 74   | .    | .    | .    | 0.006 |
| 75   | .    | .    | .    | 0.005 |
| 76   | .    | .    | .    | 0.005 |
| 77   | .    | .    | .    | 0.005 |
| 78   | .    | .    | .    | 0.005 |
| 79   | .    | .    | .    | 0.005 |
| 80   | .    | .    | 50   | 0.004 |
| 81   | .    | .    | 50   | 0.004 |
| 83   | .    | .    | 50   | 0.004 |
| 84   | .    | .    | 50   | 0.004 |
| 85   | .    | .    | 51   | 0.003 |
| 86   | .    | .    | 54   | 0.003 |
| 87   | .    | .    | 56   | 0.003 |
| 87   | .    | .    | 57   | 0.003 |
| 87   | .    | .    | 60   | 0.003 |
| 88   | .    | .    | 61   | 0.002 |
| 89   | .    | .    | 63   | 0.002 |
| 90   | .    | .    | 64   | 0.002 |
| 91   | .    | .    | 66   | 0.002 |
| 92   | .    | .    | 67   | 0.002 |
| 93   | .    | .    | 68   | 0.002 |
| 97   | .    | .    | 70   | 0.002 |
| 97   | .    | .    | 72   | 0.002 |
| 100  | .    | .    | 73   | 0.001 |
| 102  | .    | .    | 74   | 0.001 |
| 103  | .    | .    | 77   | 0.001 |
| 105  | .    | .    | 79   | 0.001 |
| 106  | .    | .    | 80   | 0.001 |
| 112  | .    | .    | 80   | 0.001 |
| 113  | 50   | 50   | 83   | 0.000 |
| 121  | 50   | 57   | 114  | 0.000 |
| 136  | 50   | 57   | 114  | 0.000 |
| 198  | 50   | 57   | 114  | 0.000 |
| 201  | 50   | 57   | 114  | 0.000 |

Table 3.3-1 (continued). Attenuation and rain rate percent-of-time data for June 1977 through March 1978.



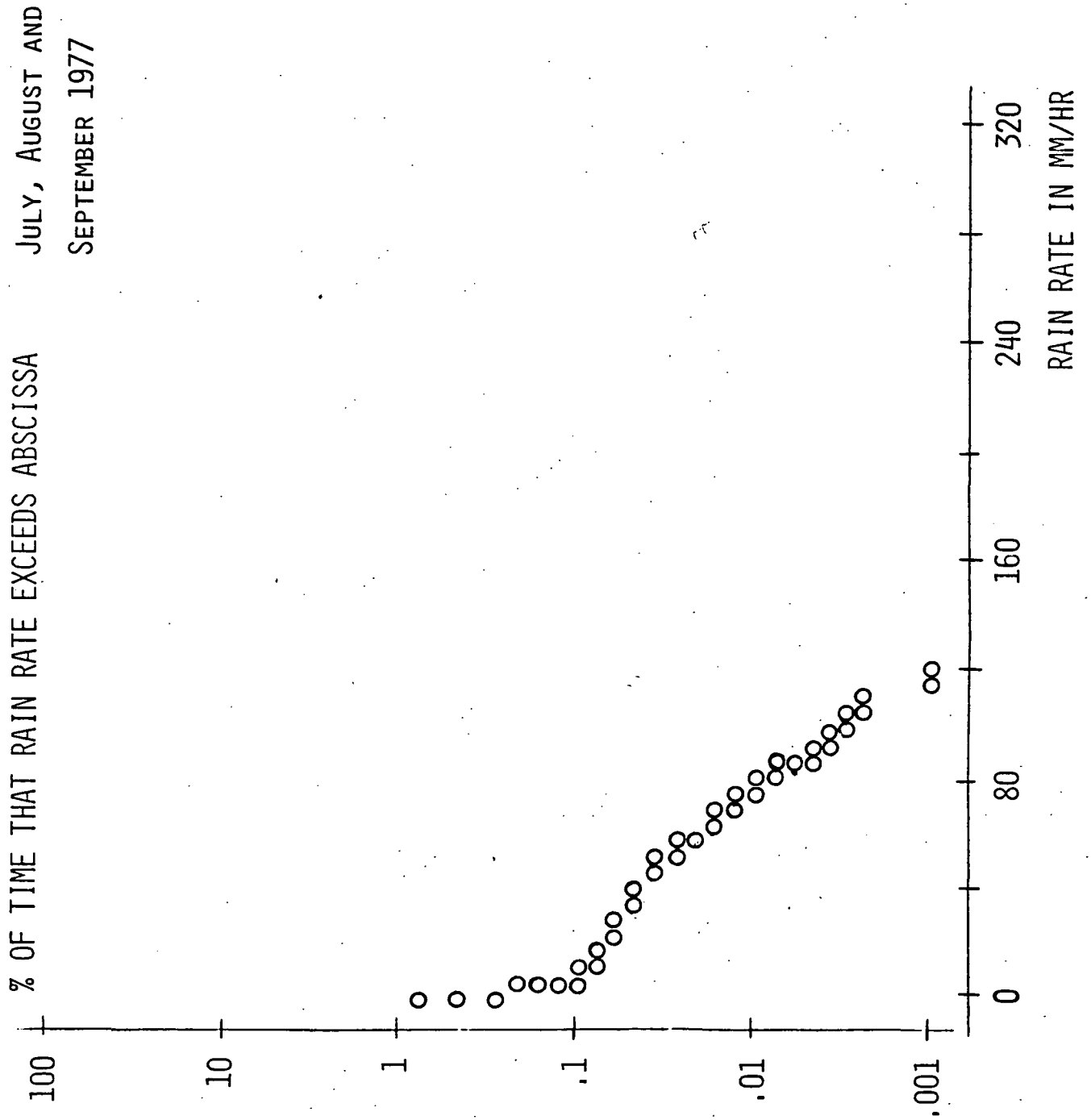


Figure 3.4-1. Rain rate statistics for July, August, and September, 1977.

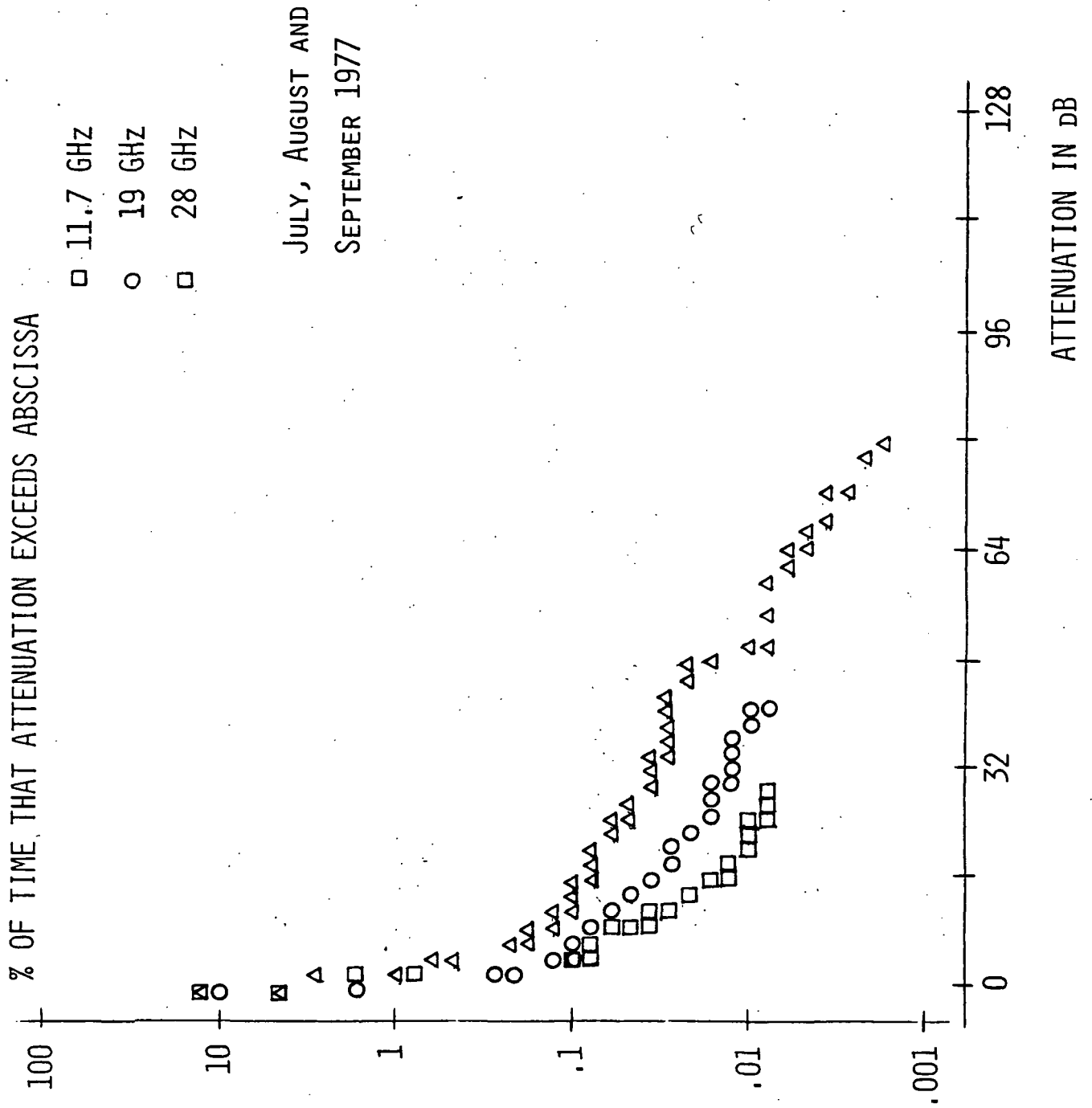


Figure 3.4-2. Attenuation statistics for July, August, and September, 1977.

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| RAIN | ACTS | AV19 | AC28 | PER    |
|------|------|------|------|--------|
| .    | .    | .    | 0    | 17.075 |
| .    | 0    | .    | .    | 14.150 |
| .    | .    | 0    | .    | 13.738 |
| .    | .    | .    | 1    | 6.421  |
| .    | 1    | .    | .    | 5.666  |
| .    | .    | .    | 2    | 3.602  |
| .    | .    | 1    | .    | 2.238  |
| .    | 2    | .    | .    | 1.857  |
| .    | .    | .    | 3    | 1.533  |
| .    | 3    | .    | .    | 0.878  |
| 0    | .    | .    | .    | 0.840  |
| .    | .    | .    | 4    | 0.790  |
| .    | .    | .    | 5    | 0.557  |
| 1    | .    | .    | .    | 0.435  |
| .    | .    | 2    | .    | 0.379  |
| 2    | .    | .    | 6    | 0.303  |
| .    | .    | 3    | .    | 0.243  |
| 3    | .    | .    | .    | 0.219  |
| .    | .    | .    | 7    | 0.194  |
| .    | .    | .    | 8    | 0.169  |
| 4    | .    | .    | .    | 0.161  |
| .    | .    | 4    | .    | 0.160  |
| .    | .    | .    | 9    | 0.151  |
| 5    | .    | .    | .    | 0.144  |
| .    | .    | .    | 10   | 0.140  |
| .    | 4    | 5    | .    | 0.137  |
| .    | .    | .    | 11   | 0.129  |
| 6    | .    | .    | .    | 0.128  |
| .    | .    | 6    | .    | 0.125  |
| 7    | .    | .    | .    | 0.119  |
| .    | .    | .    | 12   | 0.118  |
| 8    | .    | .    | 13   | 0.110  |
| .    | 5    | .    | .    | 0.107  |
| .    | .    | 7    | .    | 0.106  |
| 9    | .    | .    | .    | 0.105  |
| .    | .    | .    | 14   | 0.104  |
| 10   | .    | .    | .    | 0.099  |
| .    | .    | 8    | .    | 0.098  |
| .    | 6    | .    | 15   | 0.097  |
| .    | .    | .    | 16   | 0.094  |
| 11   | .    | .    | .    | 0.093  |
| 12   | .    | .    | 17   | 0.091  |
| 13   | .    | .    | .    | 0.085  |
| .    | .    | 9    | .    | 0.084  |
| .    | 7    | .    | 18   | 0.083  |
| 14   | .    | 10   | .    | 0.081  |
| 15   | .    | .    | 19   | 0.079  |
| 16   | 8    | .    | 20   | 0.077  |
| 17   | .    | .    | .    | 0.075  |
| 18   | .    | .    | .    | 0.074  |
| 19   | .    | .    | .    | 0.072  |
| .    | .    | .    | 21   | 0.071  |
| 20   | .    | .    | .    | 0.070  |
| .    | .    | 11   | .    | 0.069  |

Table 3.4-1. Attenuation and rain rate percent-of-time data for July, August, and September, 1977.

| RAIN | ACTS | AV19 | AC28 | PER   |
|------|------|------|------|-------|
| 21   | .    | .    | .    | 0.068 |
| 22   | .    | 12   | 22   | 0.067 |
| 23   | .    | .    | .    | 0.063 |
| 24   | 9    | .    | 23   | 0.062 |
| 25   | .    | .    | .    | 0.061 |
| 26   | .    | .    | .    | 0.059 |
| 27   | .    | .    | .    | 0.059 |
| 28   | .    | .    | 24   | 0.058 |
| 29   | .    | .    | .    | 0.057 |
| 30   | .    | 13   | .    | 0.056 |
| 31   | .    | .    | .    | 0.055 |
| 32   | .    | .    | 25   | 0.054 |
| 33   | .    | 14   | 26   | 0.053 |
| 34   | .    | .    | .    | 0.052 |
| 35   | .    | .    | .    | 0.051 |
| 36   | .    | .    | .    | 0.050 |
| 37   | 10   | 15   | 27   | 0.049 |
| 38   | .    | .    | .    | 0.049 |
| 39   | .    | .    | 28   | 0.048 |
| 40   | 11   | 16   | .    | 0.047 |
| 40   | 11   | 16   | 29   | 0.046 |
| 41   | .    | .    | 30   | 0.045 |
| 42   | .    | 17   | 31   | 0.045 |
| 43   | .    | .    | 32   | 0.043 |
| 44   | .    | .    | .    | 0.043 |
| 44   | .    | 18   | 33   | 0.042 |
| 45   | .    | 18   | 34   | 0.041 |
| .    | .    | .    | 35   | 0.040 |
| .    | .    | 19   | 36   | 0.039 |
| .    | .    | 19   | 37   | 0.038 |
| 46   | 12   | 20   | 38   | 0.038 |
| 46   | 12   | 20   | 39   | 0.037 |
| 47   | .    | .    | 40   | 0.036 |
| 48   | .    | .    | 41   | 0.036 |
| 49   | .    | 21   | 42   | 0.035 |
| 50   | .    | .    | 43   | 0.035 |
| .    | .    | .    | 44   | 0.034 |
| 51   | 13   | 22   | .    | 0.033 |
| 52   | .    | .    | 45   | 0.032 |
| 53   | .    | .    | 45   | 0.031 |
| 54   | 14   | 23   | .    | 0.030 |
| 55   | 14   | 23   | .    | 0.029 |
| .    | .    | .    | 47   | 0.028 |
| 56   | .    | 24   | 48   | 0.028 |
| 57   | .    | .    | 49   | 0.026 |
| 58   | .    | 25   | .    | 0.026 |
| 58   | .    | 26   | .    | 0.025 |
| .    | 15   | .    | .    | 0.024 |
| 59   | 16   | 27   | .    | 0.023 |
| .    | .    | 28   | .    | 0.023 |
| 60   | 17   | 30   | .    | 0.022 |
|      |      |      |      | 0.022 |
|      |      |      |      | 0.021 |
|      |      |      |      | 0.020 |
|      |      |      |      | 0.019 |
|      |      |      |      | 0.018 |

Table 3.4-1 (continued). Attenuation and rain rate percent-of-time data for July, August, and September, 1977.

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| RAIN | ACTS | AV19 | AC28 | PER   |
|------|------|------|------|-------|
| 61   | 18   | 31   | .    | 0.017 |
| 62   | 18   | 32   | .    | 0.017 |
| 63   | 18   | 32   | .    | 0.017 |
| 64   | .    | 33   | .    | 0.016 |
| 64   | .    | 34   | .    | 0.016 |
| 65   | 19   | 35   | .    | 0.015 |
| 65   | 19   | 36   | .    | 0.015 |
| 69   | .    | 37   | .    | 0.014 |
| 69   | .    | 38   | .    | 0.014 |
| 70   | .    | 39   | .    | 0.013 |
| 72   | .    | 39   | .    | 0.013 |
| 74   | 20   | 40   | 50   | 0.012 |
| 74   | 21   | 40   | 50   | 0.012 |
| 74   | 23   | 40   | 50   | 0.012 |
| 75   | 24   | 41   | 51   | 0.011 |
| 75   | 25   | 41   | 51   | 0.011 |
| 75   | 27   | 41   | 51   | 0.011 |
| 76   | 28   | .    | 54   | 0.010 |
| 79   | .    | .    | 56   | 0.009 |
| 80   | .    | .    | 57   | 0.009 |
| 80   | .    | .    | 60   | 0.009 |
| 81   | .    | .    | 61   | 0.008 |
| 85   | .    | .    | 63   | 0.007 |
| 85   | .    | .    | 64   | 0.007 |
| 86   | .    | .    | 66   | 0.006 |
| 88   | .    | .    | 67   | 0.006 |
| 91   | .    | .    | 68   | 0.006 |
| 92   | .    | .    | 70   | 0.005 |
| 93   | .    | .    | 72   | 0.005 |
| 93   | .    | .    | 73   | 0.005 |
| 97   | .    | .    | 74   | 0.004 |
| 100  | .    | .    | 74   | 0.004 |
| 102  | .    | .    | 77   | 0.003 |
| 103  | .    | .    | 79   | 0.003 |
| 106  | .    | .    | 79   | 0.003 |
| 112  | .    | .    | 80   | 0.002 |
| 113  | .    | .    | .    | 0.001 |
| 121  | .    | .    | .    | 0.001 |
| 198  | 50   | 50   | 83   | 0.000 |
| 201  | 50   | 57   | 114  | 0.000 |

Table 3.4-1 (continued). Attenuation and rain rate percent-of-time data for July, August, and September, 1977.

Table 3.4-2. Regression equations for July, August, and September, 1977.

| Relationship                                                   | 11.7 GHz                              |                |                |  | 19.04 GHz                             |                |                |  | 28.56 GHz                            |                |                |  |
|----------------------------------------------------------------|---------------------------------------|----------------|----------------|--|---------------------------------------|----------------|----------------|--|--------------------------------------|----------------|----------------|--|
|                                                                | Equation                              | N <sub>s</sub> | R <sup>2</sup> |  | Equation                              | N <sub>s</sub> | R <sup>2</sup> |  | Equation                             | N <sub>s</sub> | R <sup>2</sup> |  |
| I on log <sub>10</sub> (A)<br>for 3 < A < 30                   |                                       |                |                |  |                                       |                |                |  |                                      |                |                |  |
| A on R at equal<br>probability levels.                         | A = .54*<br>R <sup>.85</sup>          | 25             | .91            |  | A = .89*<br>R <sup>.84</sup>          | 38             | .84            |  | A = 2.96*<br>R <sup>.68</sup>        | 51             | .96            |  |
| Attenuation scaling.<br>A (11) at equal<br>probability levels. |                                       |                |                |  | A(11) = .73*<br>A(19) <sup>.95</sup>  | 23             | .90            |  | A(11) = .23*<br>A(28) <sup>.17</sup> | 16             | .94            |  |
| Attenuation scaling.<br>A (19) at equal<br>probability levels. | A(19) = 1.85*<br>A(11) <sup>.95</sup> | 23             | .90            |  |                                       |                |                |  | A(19) = .33*<br>A(28) <sup>.16</sup> | 19             | .82            |  |
| Attenuation scaling.<br>A (28) at equal<br>probability levels. | A(28) = 4.06*<br>A(11) <sup>.81</sup> | 16             | .94            |  | A(28) = 4.27*<br>A(19) <sup>.71</sup> | 19             | .82            |  |                                      |                |                |  |

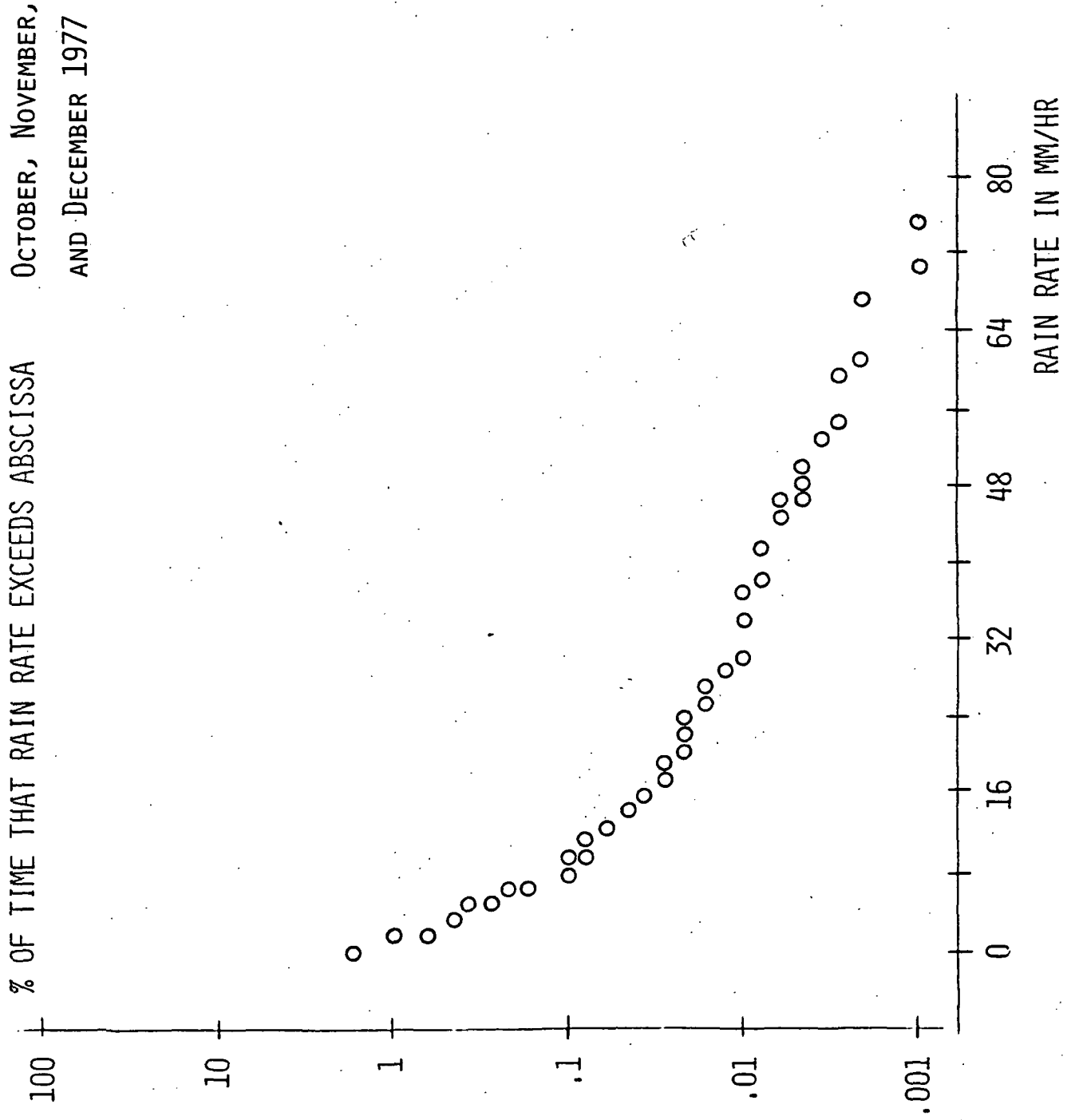


Figure 3.5-1. Rain rate statistics for October, November, and December, 1977.

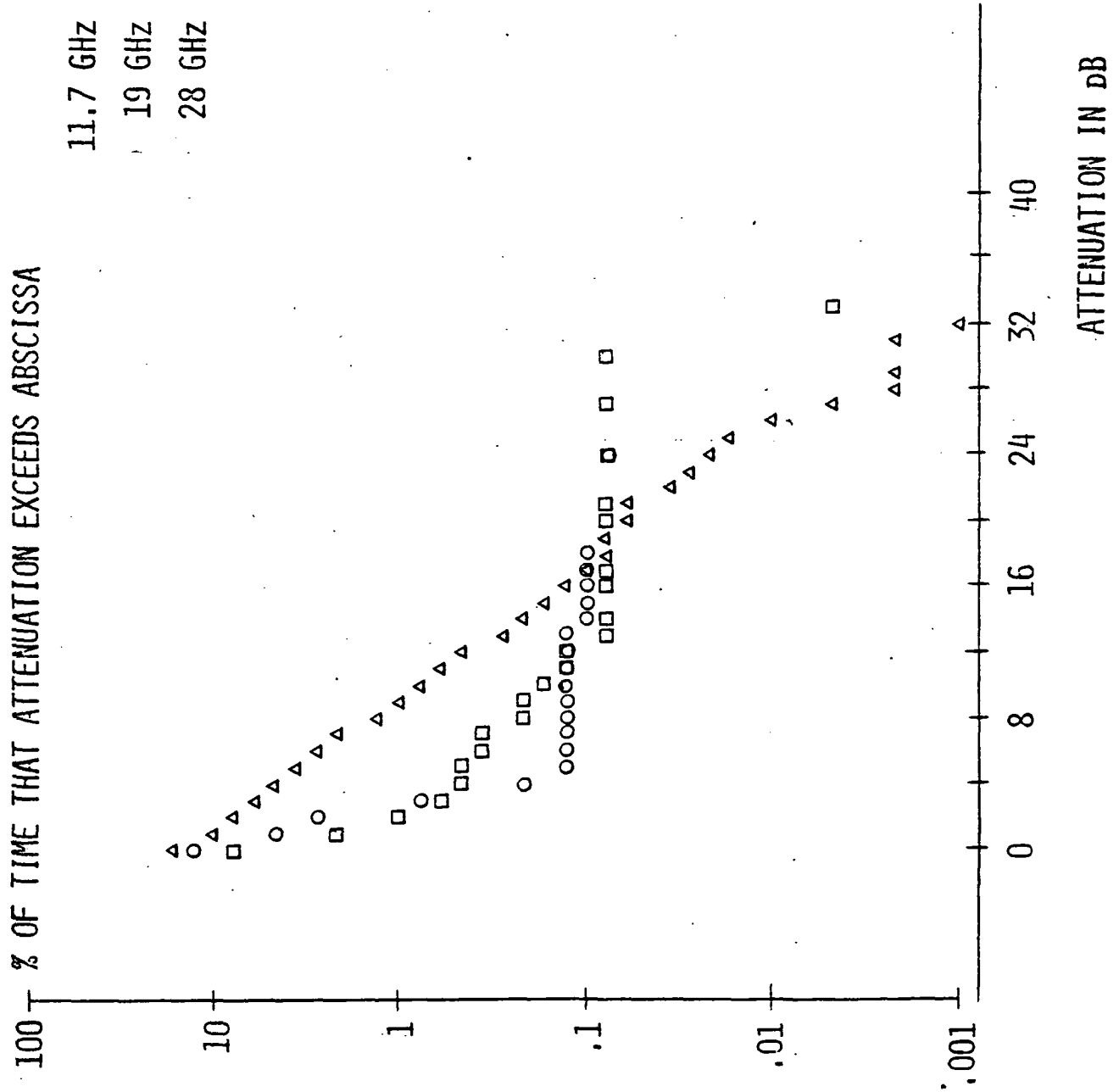


Figure 3.5-2. Attenuation statistics for October, November, and December, 1977.



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| RAIN | ACTS | AV19 | AC28 | PER    |
|------|------|------|------|--------|
| .    | .    | 0    | 0    | 16.619 |
| .    | .    | 0    | 1    | 11.465 |
| .    | 0    | .    | .    | 9.739  |
| .    | .    | .    | 2    | 8.748  |
| .    | .    | .    | 3    | 6.884  |
| .    | .    | 1    | .    | 5.298  |
| .    | .    | .    | 4    | 4.839  |
| .    | .    | .    | 5    | 4.213  |
| .    | .    | 2    | .    | 3.362  |
| .    | .    | .    | 6    | 2.587  |
| .    | 1    | .    | .    | 2.560  |
| .    | .    | .    | 7    | 1.916  |
| 0    | .    | .    | .    | 1.904  |
| .    | .    | .    | 8    | 1.835  |
| 1    | .    | .    | .    | 1.286  |
| .    | 2    | .    | 9    | 1.060  |
| .    | .    | .    | .    | 0.933  |
| .    | .    | .    | 10   | 0.897  |
| .    | 2    | 3    | .    | 0.746  |
| 2    | .    | .    | .    | 0.685  |
| .    | 3    | .    | .    | 0.672  |
| .    | 4    | .    | 11   | 0.551  |
| 3    | .    | .    | .    | 0.549  |
| .    | 5    | .    | .    | 0.516  |
| .    | 6    | .    | .    | 0.494  |
| .    | .    | .    | 12   | 0.464  |
| 4    | 7    | .    | .    | 0.409  |
| .    | .    | .    | .    | 0.401  |
| 5    | .    | .    | 13   | 0.371  |
| .    | 8    | .    | .    | 0.322  |
| .    | 9    | .    | 14   | 0.300  |
| 6    | .    | .    | .    | 0.276  |
| .    | 10   | 4    | 15   | 0.242  |
| .    | .    | .    | .    | 0.220  |
| 7    | 11   | .    | .    | 0.205  |
| .    | .    | .    | .    | 0.202  |
| .    | 12   | .    | 16   | 0.198  |
| .    | .    | 5    | .    | 0.179  |
| .    | .    | 6    | .    | 0.160  |
| .    | .    | 7    | .    | 0.150  |
| .    | .    | 8    | .    | 0.143  |
| .    | .    | 9    | .    | 0.129  |
| .    | .    | 10   | .    | 0.127  |
| .    | .    | 11   | .    | 0.123  |
| .    | .    | 12   | .    | 0.121  |
| .    | .    | 13   | .    | 0.119  |
| .    | .    | 14   | .    | 0.118  |
| .    | .    | 15   | .    | 0.116  |
| .    | .    | 16   | .    | 0.115  |
| .    | .    | .    | .    | 0.114  |
| .    | .    | .    | .    | 0.114  |
| .    | .    | .    | .    | 0.113  |
| .    | .    | .    | .    | 0.113  |
| .    | .    | .    | .    | 0.112  |

Table 3.5-1. Attenuation and rain rate percent-of-time data for October, November, and December, 1977.

| RAIN | ACTS | AV19 | AC28 | PER   |
|------|------|------|------|-------|
| .    | .    | 17   | .    | 0.112 |
| .    | .    | 18   | .    | 0.111 |
| 8    | .    | .    | .    | 0.108 |
| .    | .    | .    | 17   | 0.100 |
| 9    | .    | .    | .    | 0.093 |
| .    | .    | .    | 18   | 0.086 |
| .    | 13   | .    | .    | 0.080 |
| .    | 14   | .    | .    | 0.079 |
| 10   | 16   | 24   | .    | 0.078 |
| 10   | 17   | 24   | .    | 0.078 |
| .    | 20   | .    | .    | 0.077 |
| .    | 21   | .    | .    | 0.077 |
| .    | 24   | .    | .    | 0.077 |
| .    | 27   | .    | .    | 0.076 |
| .    | 30   | .    | .    | 0.076 |
| 11   | .    | .    | .    | 0.071 |
| .    | .    | .    | 19   | 0.070 |
| 12   | .    | .    | 20   | 0.064 |
| 13   | .    | .    | .    | 0.058 |
| .    | .    | .    | 21   | 0.053 |
| 14   | .    | .    | .    | 0.052 |
| 15   | .    | .    | .    | 0.045 |
| .    | .    | .    | 22   | 0.039 |
| 16   | .    | .    | .    | 0.034 |
| 17   | .    | .    | .    | 0.033 |
| .    | .    | .    | 23   | 0.029 |
| 18   | .    | .    | .    | 0.028 |
| 19   | .    | .    | .    | 0.027 |
| 20   | .    | .    | .    | 0.024 |
| .    | .    | .    | 24   | 0.023 |
| 21   | .    | .    | .    | 0.022 |
| 22   | .    | .    | .    | 0.022 |
| 23   | .    | .    | .    | 0.020 |
| 24   | .    | .    | .    | 0.019 |
| 25   | .    | .    | 25   | 0.016 |
| 26   | .    | .    | .    | 0.015 |
| 27   | .    | .    | .    | 0.014 |
| 28   | .    | .    | .    | 0.013 |
| 29   | .    | .    | .    | 0.012 |
| 30   | .    | .    | .    | 0.011 |
| 31   | .    | .    | .    | 0.010 |
| 33   | .    | .    | 26   | 0.009 |
| 36   | .    | .    | 26   | 0.009 |
| 37   | .    | .    | .    | 0.008 |
| 38   | .    | .    | .    | 0.008 |
| 39   | .    | .    | .    | 0.008 |
| 42   | .    | .    | .    | 0.007 |
| 45   | .    | .    | .    | 0.006 |
| 47   | .    | .    | .    | 0.006 |
| 48   | 33   | .    | 27   | 0.005 |
| 49   | 33   | .    | 27   | 0.005 |
| 52   | 33   | .    | 27   | 0.005 |
| 55   | .    | .    | .    | 0.004 |
| 59   | .    | .    | .    | 0.004 |

Table 3.5-1 (continued). Attenuation and rain rate percent-of-time data for October, November, and December, 1977.

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| RAIN | ACTS | AV19 | AC28 | PER   |
|------|------|------|------|-------|
| 60   | .    | .    | .    | 0.003 |
| 61   | .    | .    | .    | 0.003 |
| 66   | .    | .    | 28   | 0.002 |
| 71   | .    | .    | 29   | 0.002 |
| 75   | .    | .    | 31   | 0.002 |
| 77   | .    | .    | 32   | 0.001 |
| 79   | .    | .    | 32   | 0.001 |
| 80   | 43   | 25   | 34   | 0.000 |
| 85   | 43   | 26   | 36   | 0.000 |

Table 3.5-1 (continued). Attenuation and rain rate  
percent-of-time data for  
October, November, and  
December, 1977.

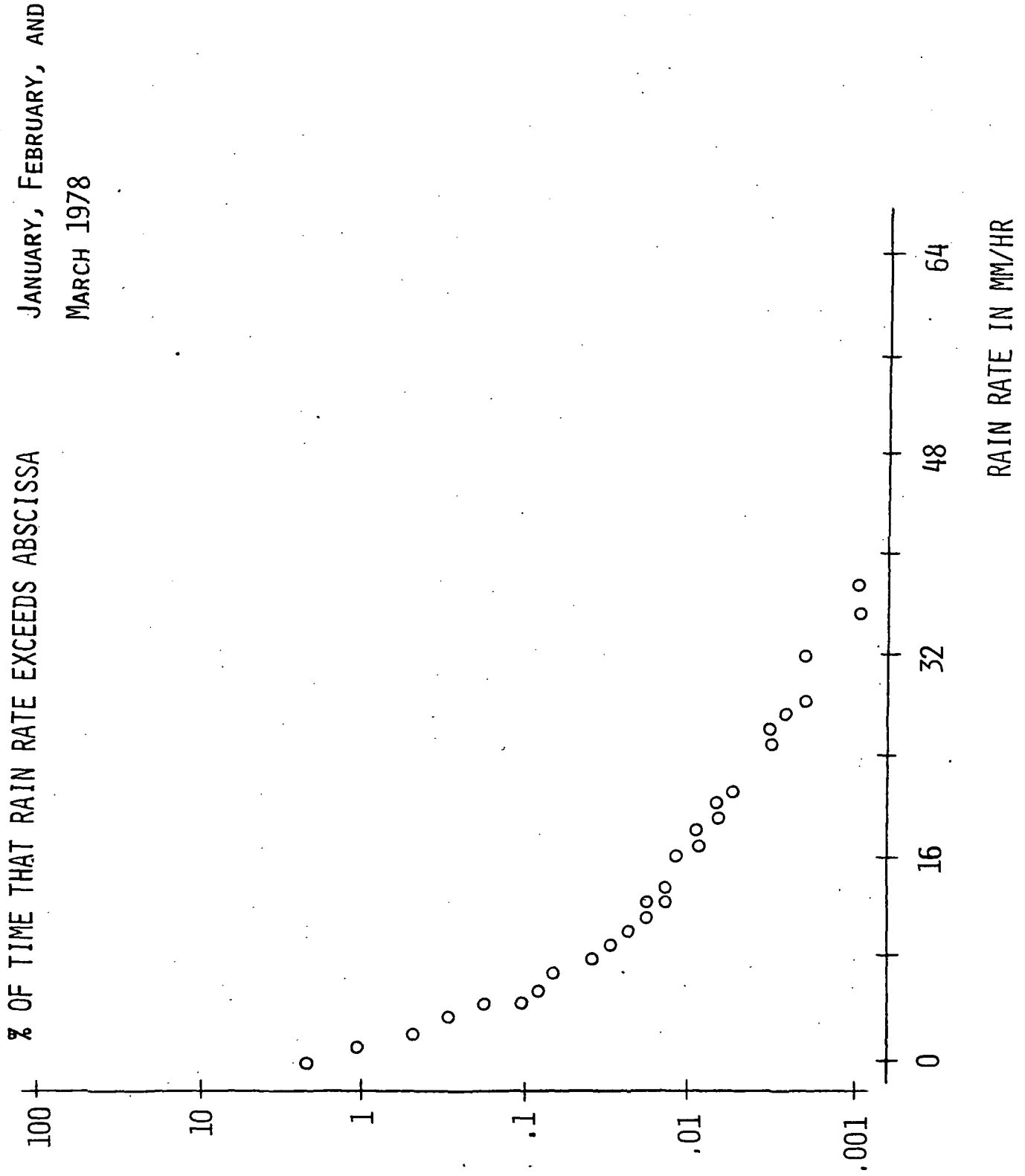


Figure 3.6-1. Rain rate statistics for January, February, and March, 1978.

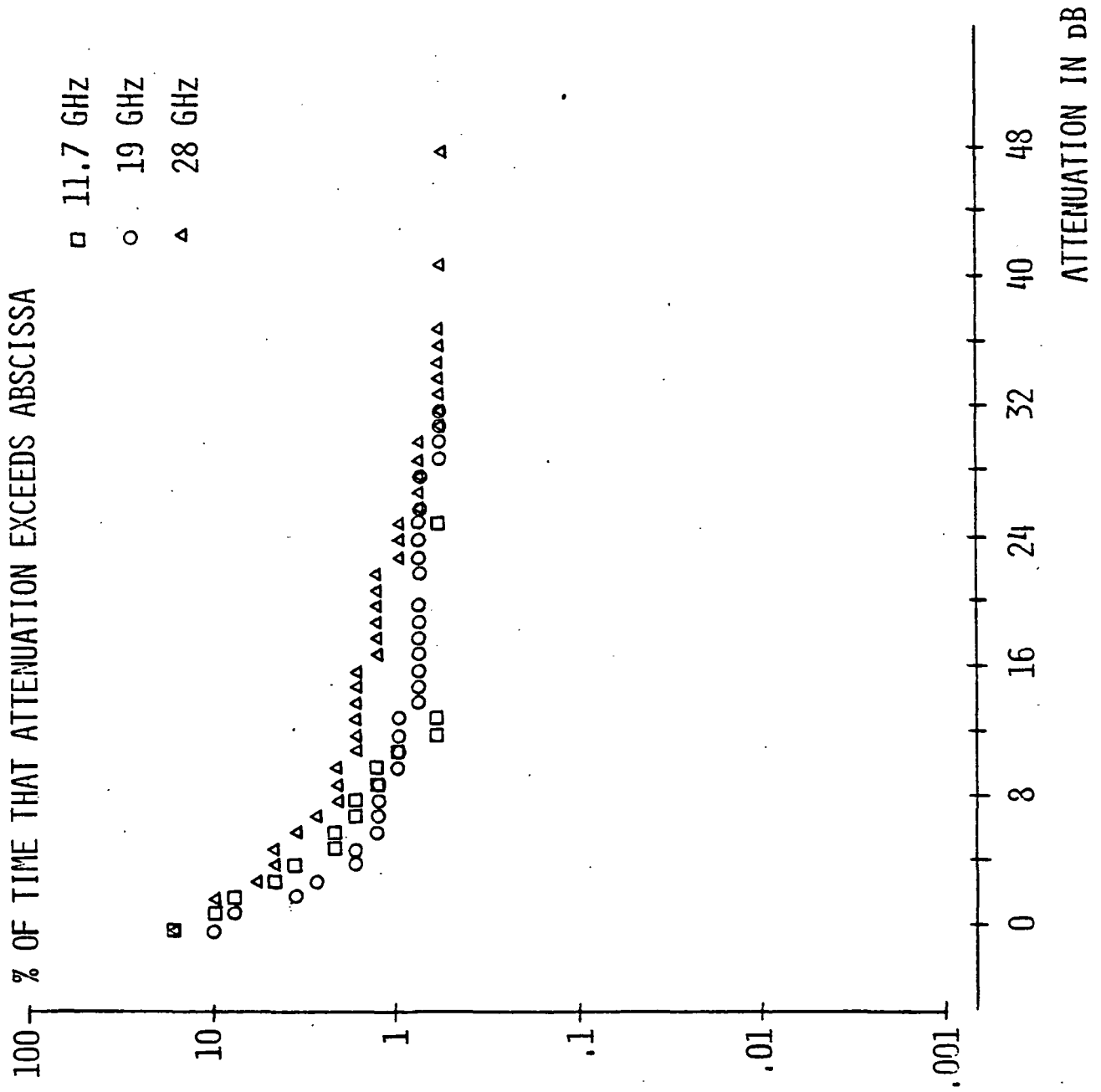


Figure 3.6-2. Attenuation statistics for January, February, and March 1978.

| RAIN | ACTS | AV19 | AC28 | PER    |
|------|------|------|------|--------|
| .    | 0    | .    | .    | 18.409 |
| .    | .    | .    | 0    | 16.411 |
| .    | .    | .    | 1    | 11.330 |
| .    | .    | 0    | .    | 11.094 |
| .    | 1    | .    | .    | 11.035 |
| .    | .    | .    | 2    | 8.910  |
| .    | .    | 1    | .    | 7.390  |
| .    | 2    | .    | .    | 7.140  |
| .    | .    | .    | 3    | 6.642  |
| .    | .    | .    | 4    | 5.266  |
| .    | .    | .    | 5    | 4.315  |
| .    | 3    | .    | .    | 4.243  |
| .    | .    | 2    | .    | 3.755  |
| .    | .    | .    | 6    | 3.394  |
| 0    | 4    | .    | .    | 3.307  |
| .    | .    | .    | .    | 2.900  |
| .    | .    | 3    | .    | 2.820  |
| .    | .    | .    | 7    | 2.606  |
| .    | 5    | .    | .    | 2.423  |
| .    | .    | .    | 8    | 2.374  |
| .    | .    | .    | 9    | 2.202  |
| .    | 6    | .    | .    | 2.166  |
| .    | .    | .    | 10   | 2.072  |
| .    | .    | .    | 11   | 1.844  |
| .    | .    | 4    | .    | 1.786  |
| .    | .    | .    | 12   | 1.763  |
| .    | 7    | .    | .    | 1.672  |
| .    | .    | 5    | .    | 1.625  |
| .    | .    | .    | 13   | 1.614  |
| .    | .    | .    | 14   | 1.580  |
| .    | .    | .    | 15   | 1.528  |
| .    | 8    | .    | .    | 1.502  |
| .    | .    | .    | 16   | 1.476  |
| .    | .    | .    | 17   | 1.453  |
| .    | .    | .    | 18   | 1.420  |
| .    | 9    | .    | .    | 1.404  |
| .    | .    | .    | 19   | 1.391  |
| .    | .    | 6    | .    | 1.349  |
| .    | .    | .    | 20   | 1.308  |
| .    | 10   | .    | 21   | 1.258  |
| .    | .    | 7    | .    | 1.213  |
| .    | .    | 8    | .    | 1.171  |
| .    | .    | 9    | 22   | 1.156  |
| 1    | .    | .    | .    | 1.139  |
| .    | .    | .    | 23   | 1.137  |
| .    | .    | 10   | .    | 1.094  |
| .    | .    | .    | 24   | 1.048  |
| .    | .    | 11   | .    | 1.015  |
| .    | 11   | .    | .    | 0.970  |
| .    | .    | .    | 25   | 0.940  |
| .    | .    | 12   | .    | 0.908  |
| .    | .    | 13   | .    | 0.893  |
| .    | .    | .    | 26   | 0.885  |
| .    | .    | .    | .    | 0.857  |

Table 3.6-1. Attenuation and rain rate percent-of-time data for January, February, and March, 1978. The attenuation values were caused by frozen or freezing precipitation which the rain gauges did not record.

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| RAIN | ACTS | AV19 | AC28 | PER   |
|------|------|------|------|-------|
| .    | .    | 14   | .    | 0.842 |
| .    | .    | 15   | .    | 0.816 |
| .    | .    | .    | 27   | 0.807 |
| .    | .    | 16   | 28   | 0.779 |
| .    | .    | 17   | .    | 0.768 |
| .    | .    | 18   | .    | 0.760 |
| .    | .    | 19   | .    | 0.760 |
| .    | .    | 20   | .    | 0.759 |
| .    | .    | 22   | .    | 0.758 |
| .    | .    | 23   | .    | 0.757 |
| .    | .    | 24   | .    | 0.745 |
| .    | .    | 25   | .    | 0.743 |
| .    | .    | 26   | .    | 0.742 |
| .    | .    | .    | 29   | 0.720 |
| .    | .    | 28   | .    | 0.711 |
| .    | .    | .    | 30   | 0.702 |
| .    | .    | .    | 31   | 0.670 |
| .    | .    | .    | 32   | 0.664 |
| .    | .    | 29   | .    | 0.647 |
| .    | .    | .    | 33   | 0.643 |
| .    | .    | .    | 34   | 0.635 |
| .    | .    | 30   | 35   | 0.633 |
| .    | .    | .    | 36   | 0.627 |
| .    | .    | .    | 37   | 0.627 |
| .    | .    | .    | 41   | 0.627 |
| .    | .    | 31   | .    | 0.619 |
| .    | 12   | .    | .    | 0.617 |
| .    | 13   | .    | .    | 0.616 |
| .    | 25   | 32   | 48   | 0.615 |
| 2    | .    | .    | .    | 0.611 |
| 3    | .    | .    | .    | 0.347 |
| 4    | .    | .    | .    | 0.195 |
| 5    | .    | .    | .    | 0.124 |
| 6    | .    | .    | .    | 0.099 |
| 7    | .    | .    | .    | 0.073 |
| 8    | .    | .    | .    | 0.046 |
| 9    | .    | .    | .    | 0.037 |
| 10   | .    | .    | .    | 0.028 |
| 11   | .    | .    | .    | 0.023 |
| 12   | .    | .    | .    | 0.021 |
| 13   | .    | .    | .    | 0.018 |
| 14   | .    | .    | .    | 0.015 |
| 16   | .    | .    | .    | 0.012 |
| 17   | .    | .    | .    | 0.010 |
| 18   | .    | .    | .    | 0.010 |
| 19   | .    | .    | .    | 0.008 |
| 20   | .    | .    | .    | 0.007 |
| 21   | .    | .    | .    | 0.007 |
| 22   | .    | .    | .    | 0.006 |
| 25   | .    | .    | .    | 0.004 |
| 26   | .    | .    | .    | 0.004 |
| 27   | .    | .    | .    | 0.003 |
| 28   | .    | .    | .    | 0.003 |
| 29   | .    | .    | .    | 0.002 |

Table 3.6-1 (continued). Attenuation and rain rate percent-of-time data for January, February and March, 1978. The attenuation values were caused by frozen or freezing precipitation which the rain gauges did not record.

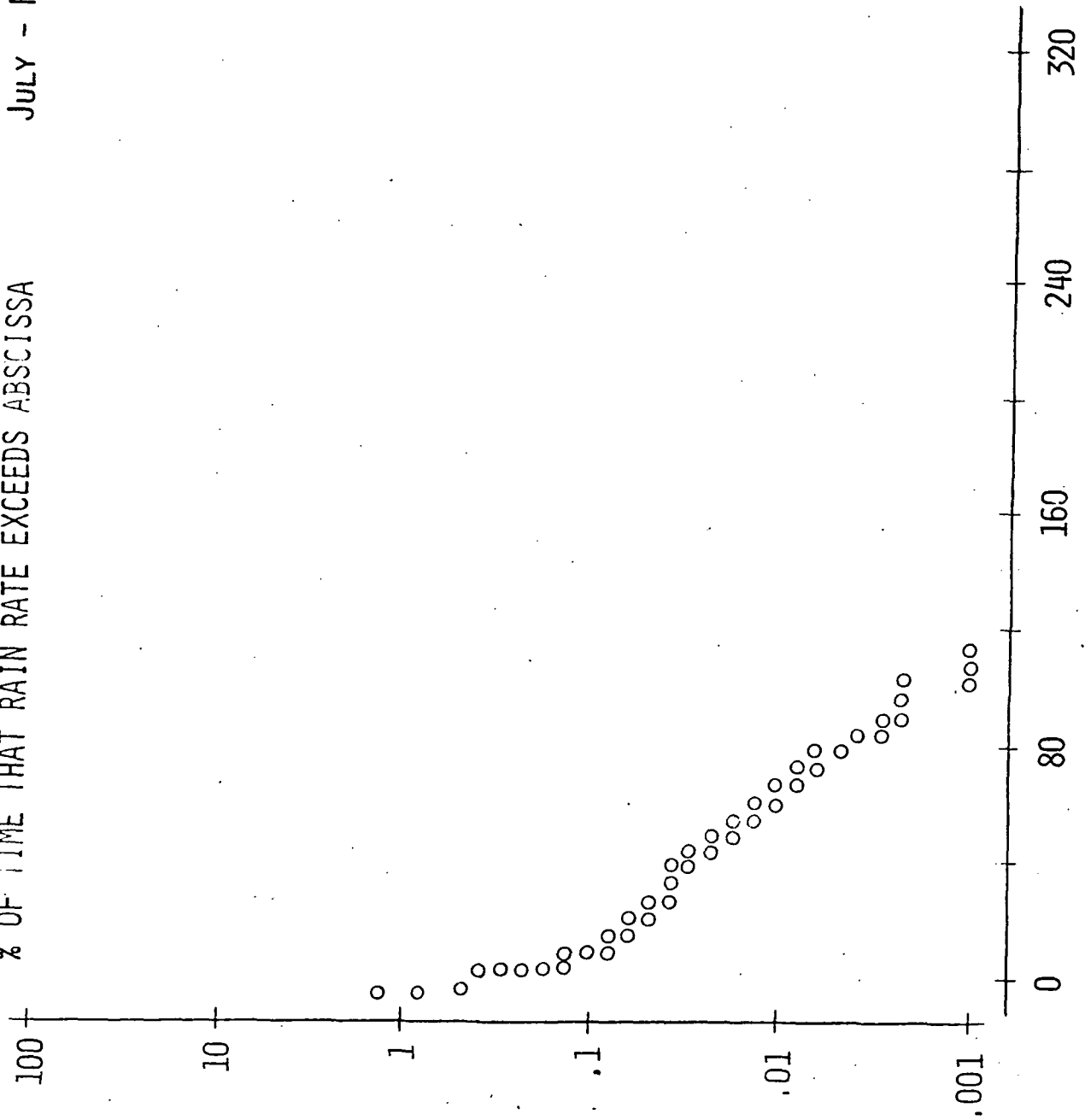
| RAIN | ACTS | AV19 | AC28 | PER   |
|------|------|------|------|-------|
| 32   | .    | .    | .    | 0.002 |
| 36   | .    | .    | .    | 0.001 |
| 38   | .    | .    | .    | 0.001 |
| 42   | 50   | 50   | 50   | 0.000 |
| 63   | 50   | 50   | 50   | 0.000 |

Table 3.6-1 (continued). Attenuation and rain rate percent-of-time data for January, February and March, 1978. The attenuation values were caused by frozen or freezing precipitation which the rain gauges did not record.



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Figure 3.7-1. Rain rate statistics for July through November, 1977.

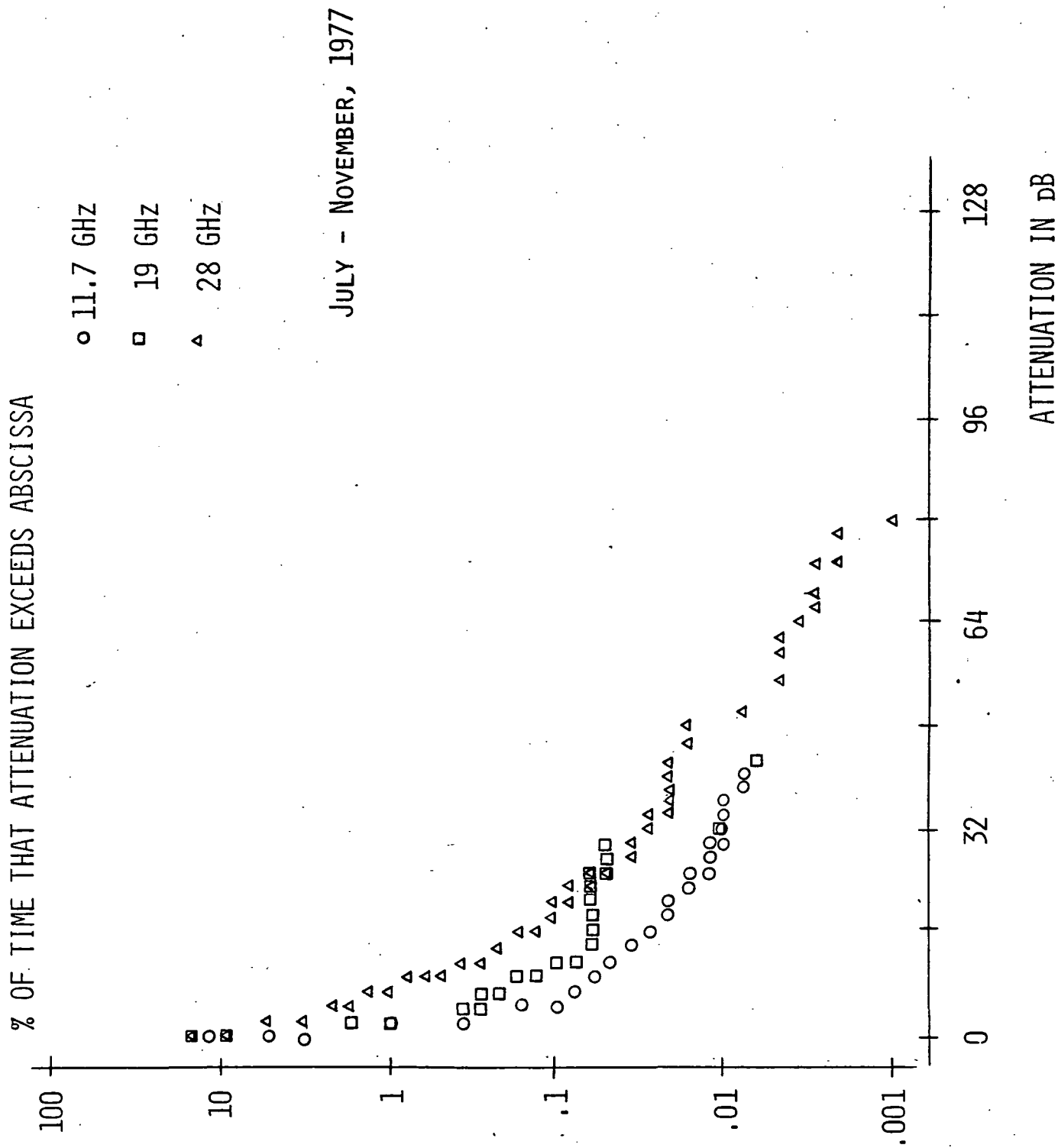


Figure 3.7-2. Attenuation statistics for July through November, 1977.

| RAIN | ACTS | AV19 | AC28 | PER    |
|------|------|------|------|--------|
| .    | .    | 0    | 0    | 15.365 |
| .    | .    | 0    | .    | 13.104 |
| .    | 0    | .    | .    | 10.991 |
| .    | .    | .    | 1    | 6.078  |
| .    | 1    | .    | .    | 4.104  |
| .    | .    | .    | 2    | 3.409  |
| .    | .    | 1    | .    | 3.264  |
| .    | .    | .    | 3    | 1.819  |
| .    | .    | 2    | .    | 1.550  |
| .    | 2    | .    | .    | 1.333  |
| 0    | .    | .    | .    | 1.319  |
| .    | .    | .    | 4    | 1.169  |
| 1    | .    | .    | 5    | 0.878  |
| .    | .    | .    | .    | 0.764  |
| .    | 3    | .    | .    | 0.668  |
| .    | .    | .    | 6    | 0.613  |
| 2    | .    | .    | .    | 0.517  |
| .    | .    | 3    | .    | 0.475  |
| .    | .    | .    | 7    | 0.433  |
| 3    | .    | .    | .    | 0.382  |
| .    | .    | .    | 8    | 0.318  |
| 4    | .    | .    | .    | 0.300  |
| .    | .    | .    | 9    | 0.253  |
| 5    | .    | .    | .    | 0.241  |
| .    | 4    | .    | .    | 0.210  |
| .    | .    | .    | 10   | 0.209  |
| 6    | .    | .    | .    | 0.189  |
| .    | 5    | .    | .    | 0.179  |
| .    | .    | 4    | .    | 0.175  |
| .    | .    | 5    | 11   | 0.166  |
| .    | .    | .    | .    | 0.157  |
| 7    | .    | 6    | .    | 0.154  |
| .    | .    | .    | .    | 0.148  |
| .    | 6    | .    | .    | 0.143  |
| .    | .    | 7    | .    | 0.136  |
| .    | .    | 8    | 12   | 0.130  |
| 8    | .    | .    | .    | 0.128  |
| .    | .    | 9    | .    | 0.121  |
| .    | .    | 10   | .    | 0.118  |
| 9    | .    | .    | .    | 0.116  |
| .    | .    | 11   | .    | 0.110  |
| 10   | .    | 12   | .    | 0.106  |
| .    | .    | .    | 13   | 0.105  |
| .    | .    | 13   | .    | 0.101  |
| .    | .    | 14   | .    | 0.098  |
| 11   | 7    | .    | .    | 0.097  |
| .    | .    | 15   | .    | 0.095  |
| .    | .    | 16   | 14   | 0.093  |
| 12   | .    | .    | .    | 0.092  |
| .    | .    | 17   | .    | 0.091  |
| .    | .    | 18   | .    | 0.089  |
| .    | .    | 19   | .    | 0.088  |
| .    | .    | 20   | .    | 0.087  |
| .    | .    | 21   | .    | 0.086  |

Table 3.7-1. Attenuation and rain rate  
percent-of-time data for  
July through November, 1977.

| RAIN | ACTS | AV19 | AC28 | PER   |
|------|------|------|------|-------|
| 13   | .    | .    | .    | 0.085 |
| .    | .    | 22   | .    | 0.084 |
| .    | .    | 23   | .    | 0.082 |
| .    | .    | .    | 15   | 0.081 |
| 14   | .    | .    | .    | 0.079 |
| 15   | .    | .    | .    | 0.074 |
| .    | .    | .    | 16   | 0.072 |
| 16   | .    | .    | .    | 0.067 |
| 17   | .    | .    | .    | 0.065 |
| .    | .    | .    | 17   | 0.064 |
| 18   | .    | 24   | .    | 0.061 |
| 19   | .    | .    | .    | 0.059 |
| .    | .    | .    | 18   | 0.058 |
| 20   | 8    | .    | .    | 0.056 |
| 21   | .    | .    | 19   | 0.054 |
| 22   | .    | .    | 20   | 0.051 |
| 23   | .    | .    | .    | 0.049 |
| 24   | .    | .    | .    | 0.048 |
| .    | .    | .    | 21   | 0.046 |
| 25   | .    | .    | .    | 0.045 |
| 26   | .    | .    | .    | 0.044 |
| 27   | .    | .    | 22   | 0.043 |
| 28   | .    | .    | .    | 0.042 |
| .    | 9    | .    | .    | 0.041 |
| 29   | .    | .    | .    | 0.040 |
| 30   | .    | .    | 23   | 0.039 |
| 31   | .    | .    | .    | 0.037 |
| 32   | .    | .    | .    | 0.037 |
| 33   | .    | .    | 24   | 0.036 |
| 34   | .    | .    | 24   | 0.036 |
| 35   | .    | .    | .    | 0.035 |
| 36   | .    | .    | 25   | 0.034 |
| 37   | .    | .    | .    | 0.033 |
| 38   | .    | .    | .    | 0.033 |
| .    | .    | .    | 26   | 0.032 |
| 39   | .    | .    | .    | 0.031 |
| 40   | 10   | .    | 27   | 0.030 |
| 41   | 10   | .    | 27   | 0.030 |
| .    | .    | .    | 28   | 0.029 |
| 42   | .    | .    | .    | 0.028 |
| 43   | 11   | .    | 29   | 0.027 |
| 44   | 11   | .    | 30   | 0.027 |
| 45   | .    | .    | .    | 0.026 |
| 46   | .    | .    | 31   | 0.025 |
| 47   | .    | .    | 32   | 0.024 |
| 48   | .    | .    | 33   | 0.023 |
| 48   | .    | .    | 34   | 0.023 |
| 49   | 12   | .    | 35   | 0.022 |
| 49   | 12   | .    | 36   | 0.022 |
| 50   | .    | .    | 37   | 0.021 |
| 50   | .    | .    | 38   | 0.021 |
| 50   | .    | .    | 39   | 0.021 |
| 50   | .    | .    | 40   | 0.021 |
| 51   | .    | .    | 41   | 0.020 |

Table 3.7-1 (continued). Attenuation and rain rate percent-of-time data for July through November, 1977.

| RAIN | ACTS | AV19 | AC28 | PER   |
|------|------|------|------|-------|
| 52   | .    | .    | 41   | 0.020 |
| 53   | 13   | .    | 42   | 0.019 |
| 54   | .    | .    | 43   | 0.018 |
| 55   | .    | .    | 44   | 0.018 |
| 56   | 14   | .    | 45   | 0.017 |
| 57   | .    | .    | .    | 0.016 |
| 58   | .    | .    | 47   | 0.015 |
| 59   | 15   | .    | 48   | 0.014 |
| 59   | 15   | .    | 49   | 0.014 |
| 60   | 16   | 25   | .    | 0.013 |
| 60   | 16   | 26   | .    | 0.013 |
| 61   | 17   | 27   | .    | 0.012 |
| 62   | 17   | 28   | .    | 0.012 |
| 63   | 17   | 28   | .    | 0.012 |
| 64   | 18   | 30   | .    | 0.011 |
| 65   | 19   | 31   | .    | 0.010 |
| 66   | 19   | 32   | .    | 0.010 |
| 69   | 19   | 33   | .    | 0.010 |
| 70   | .    | 34   | .    | 0.009 |
| 71   | .    | 35   | .    | 0.009 |
| 72   | .    | 36   | .    | 0.009 |
| 74   | .    | 37   | .    | 0.009 |
| .    | 20   | 38   | .    | 0.008 |
| .    | 21   | 39   | .    | 0.008 |
| .    | 23   | 39   | .    | 0.008 |
| 75   | 24   | 40   | 50   | 0.007 |
| 76   | 25   | 40   | 51   | 0.007 |
| 77   | 27   | 40   | 51   | 0.007 |
| 79   | 28   | 41   | 54   | 0.006 |
| 80   | 30   | 41   | 56   | 0.006 |
| 81   | .    | .    | 57   | 0.005 |
| 81   | .    | .    | 60   | 0.005 |
| 81   | .    | .    | 61   | 0.005 |
| 85   | .    | .    | 63   | 0.004 |
| 86   | .    | .    | 64   | 0.004 |
| 88   | .    | .    | 66   | 0.004 |
| 88   | .    | .    | 67   | 0.004 |
| 91   | .    | .    | 68   | 0.003 |
| 92   | .    | .    | 70   | 0.003 |
| 93   | .    | .    | 72   | 0.003 |
| 93   | .    | .    | 73   | 0.003 |
| 97   | .    | .    | 74   | 0.002 |
| 100  | .    | .    | 77   | 0.002 |
| 102  | .    | .    | 79   | 0.002 |
| 103  | .    | .    | 79   | 0.002 |
| 106  | .    | .    | 79   | 0.002 |
| 112  | .    | .    | 80   | 0.001 |
| 113  | .    | .    | 30   | 0.001 |
| 121  | 50   | 50   | 83   | 0.000 |
| 198  | 50   | 57   | 114  | 0.000 |
| 201  | 50   | 57   | 114  | 0.000 |

Table 3.7-1 (continued). Attenuation and rain rate  
percent-of-time data for  
July through November, 1977.

Table 3.7-2. Regression equations for the period July through November, 1977.

| Relationship                                                   | 11.7 GHz                            |                |                | 19.04 GHz |                |                | 28.56 GHz                             |                |                |
|----------------------------------------------------------------|-------------------------------------|----------------|----------------|-----------|----------------|----------------|---------------------------------------|----------------|----------------|
|                                                                | Equation                            | N <sub>s</sub> | R <sup>2</sup> | Equation  | N <sub>s</sub> | R <sup>2</sup> | Equation                              | N <sub>s</sub> | R <sup>2</sup> |
| I on log <sub>10</sub> (A)<br>for 3 < A < 30                   |                                     |                |                |           |                |                |                                       |                |                |
| A on R at equal<br>probability levels.                         | A = .54 R <sup>.85</sup>            | 28             | .84            | *         |                |                | A = 1.02 R <sup>.92</sup>             | 55             | .97            |
| Attenuation scaling.<br>A (11) at equal<br>probability levels. |                                     |                |                | *         |                |                | A(11) = .15*<br>A(28) <sup>1.25</sup> | 17             | .89            |
| Attenuation scaling.<br>A (19) at equal<br>probability levels. | *                                   |                |                |           |                |                | *                                     |                |                |
| Attenuation scaling.<br>A (28) at equal<br>probability levels. | A(28)=5.84*<br>A(11) <sup>.71</sup> | 17             | .89            | *         |                |                |                                       |                |                |

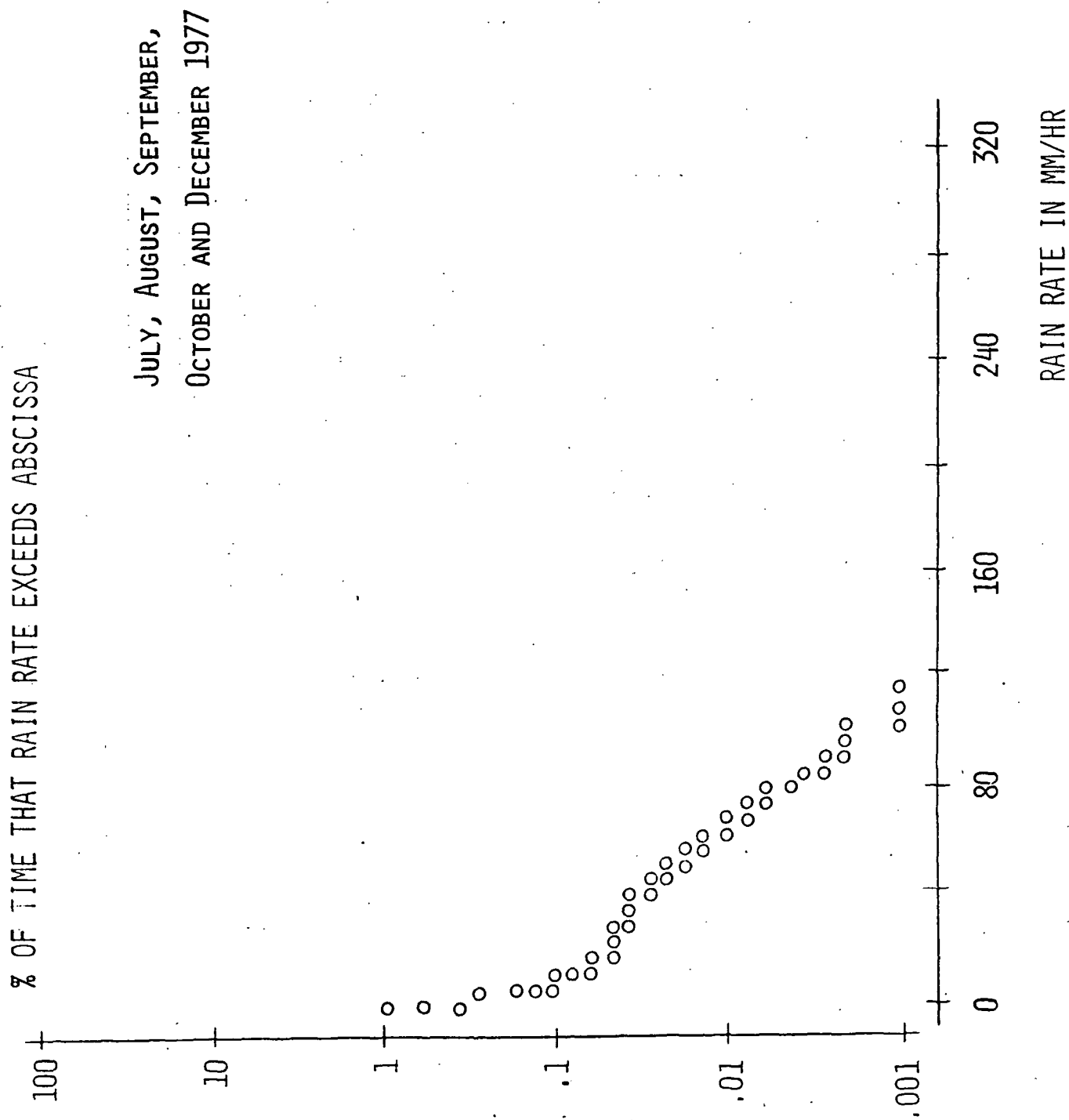


Figure 3.8-1. Rain rate statistics for July, August, September, October and December, 1977.

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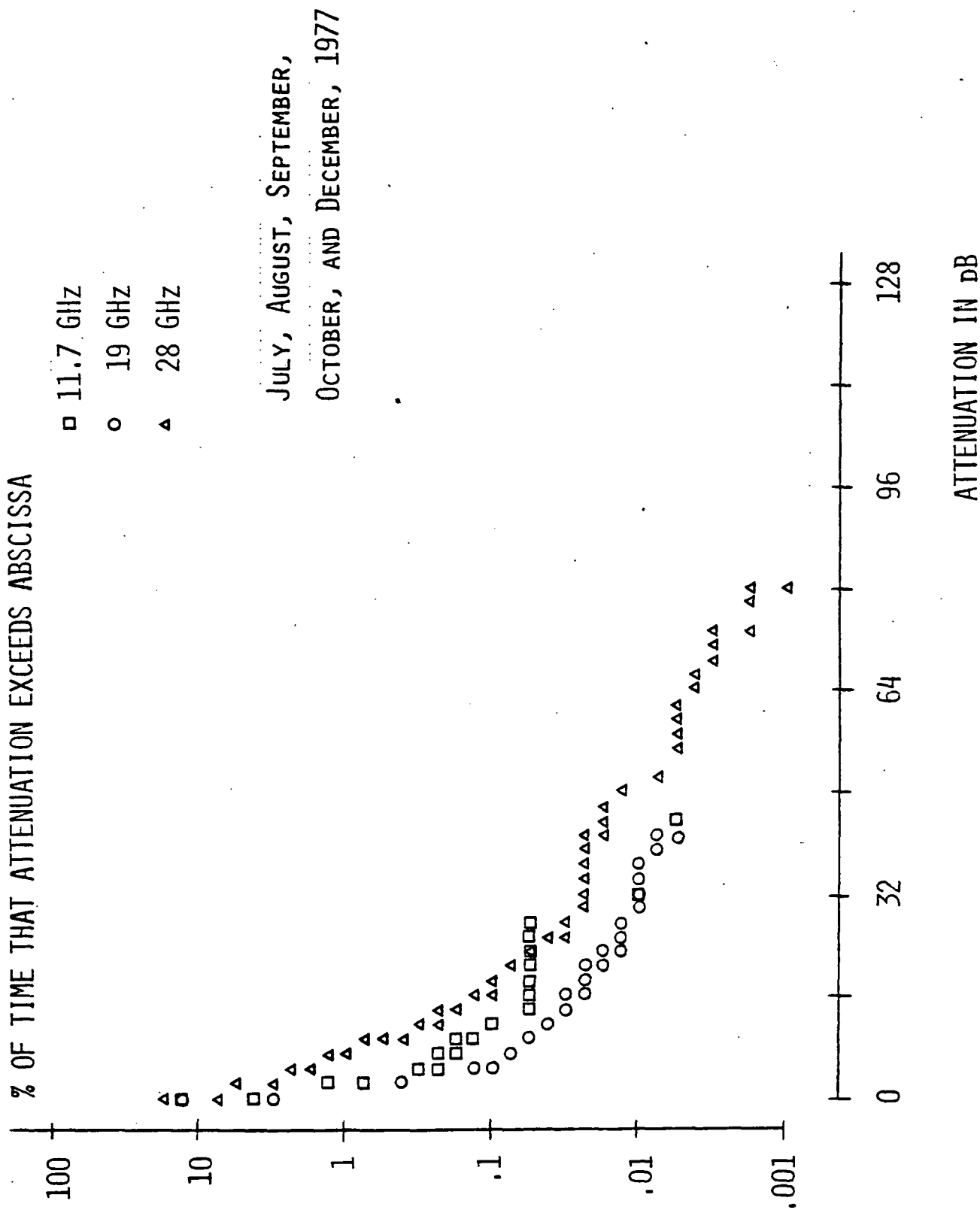


Figure 3.8-2. Attenuation statistics for July, August, September, October, and December, 1977.



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| RAIN | ACTS | ACZ8 | PER    |
|------|------|------|--------|
| .    | .    | 0.0  | 17.969 |
| .    | .    | 0.0  | 13.580 |
| .    | 0    | 0.0  | 13.098 |
| .    | .    | 1.0  | 8.487  |
| .    | .    | 2.0  | 5.410  |
| .    | 1    | 0.0  | 4.337  |
| .    | .    | 0.0  | 3.527  |
| .    | .    | 3.0  | 3.327  |
| .    | .    | 4.0  | 2.371  |
| .    | .    | 5.0  | 1.847  |
| .    | 2    | 0.0  | 1.510  |
| .    | .    | 6.0  | 1.319  |
| .    | .    | 0.0  | 1.223  |
| 0    | .    | 0.0  | 1.090  |
| .    | .    | 7.0  | 0.966  |
| .    | 3    | 0.0  | 0.733  |
| .    | .    | 8.0  | 0.676  |
| 1    | .    | 0.0  | 0.589  |
| .    | .    | 9.0  | 0.505  |
| .    | .    | 0.0  | 0.413  |
| .    | .    | 10.0 | 0.421  |
| 2    | .    | 0.0  | 0.357  |
| .    | .    | 11.0 | 0.333  |
| .    | .    | 0.0  | 0.275  |
| .    | 4    | 0.0  | 0.269  |
| .    | .    | 12.0 | 0.251  |
| 3    | .    | 0.0  | 0.236  |
| .    | 5    | 0.0  | 0.221  |
| .    | .    | 0.0  | 0.217  |
| .    | 7    | 0.0  | 0.203  |
| .    | .    | 13.0 | 0.186  |
| 4    | .    | 0.0  | 0.182  |
| .    | .    | 0.0  | 0.174  |
| .    | 8    | 0.0  | 0.156  |
| 5    | .    | 0.0  | 0.153  |
| .    | .    | 14.0 | 0.151  |
| .    | .    | 0.0  | 0.143  |
| 6    | .    | 0.0  | 0.127  |
| .    | .    | 15.0 | 0.126  |
| .    | 10   | 0.0  | 0.122  |
| 7    | .    | 0.0  | 0.113  |
| .    | 11   | 0.0  | 0.110  |
| .    | .    | 16.0 | 0.098  |
| 8    | .    | 0.0  | 0.094  |
| .    | 12   | 0.0  | 0.091  |
| 9    | .    | 0.0  | 0.088  |
| .    | .    | 17.0 | 0.087  |
| .    | .    | 0.0  | 0.082  |
| 10   | .    | 0.0  | 0.080  |
| 11   | .    | 0.0  | 0.073  |
| 12   | .    | 0.0  | 0.071  |
| .    | .    | 0.0  | 0.068  |
| 13   | .    | 0.0  | 0.067  |

Table 3.8-1. Attenuation and rain rate  
per unit time data for  
July, August, September,  
October and December, 1977.

| RAIN | ACTS | AV19 | AC28 | PER   |
|------|------|------|------|-------|
| 14   | .    | .    | .    | 0.065 |
| .    | 13   | .    | .    | 0.064 |
| .    | .    | .    | 22   | 0.063 |
| .    | 14   | 8    | .    | 0.062 |
| 15   | .    | .    | .    | 0.061 |
| .    | 15   | .    | .    | 0.059 |
| 16   | 16   | .    | .    | 0.057 |
| 16   | 17   | .    | .    | 0.057 |
| 17   | 18   | .    | .    | 0.056 |
| .    | 19   | .    | .    | 0.055 |
| 18   | .    | .    | .    | 0.054 |
| 19   | 20   | 9    | 23   | 0.053 |
| 19   | 21   | 9    | 23   | 0.053 |
| 19   | 23   | 9    | 23   | 0.053 |
| .    | 24   | .    | .    | 0.052 |
| .    | 25   | .    | .    | 0.052 |
| .    | 27   | .    | .    | 0.052 |
| .    | 28   | .    | .    | 0.052 |
| 20   | .    | 10   | .    | 0.051 |
| 21   | .    | .    | .    | 0.049 |
| .    | .    | .    | 24   | 0.047 |
| 22   | .    | .    | .    | 0.046 |
| 23   | .    | .    | .    | 0.045 |
| 24   | .    | .    | .    | 0.044 |
| .    | .    | 11   | .    | 0.043 |
| 25   | .    | .    | .    | 0.042 |
| 26   | .    | .    | .    | 0.042 |
| 27   | .    | .    | 25   | 0.041 |
| 28   | .    | 12   | .    | 0.039 |
| 29   | .    | .    | .    | 0.038 |
| 30   | .    | .    | .    | 0.037 |
| 31   | .    | .    | .    | 0.036 |
| 32   | .    | .    | 26   | 0.035 |
| 33   | .    | .    | 26   | 0.035 |
| 34   | .    | .    | 26   | 0.035 |
| 35   | .    | 13   | .    | 0.034 |
| 36   | .    | .    | .    | 0.033 |
| 37   | .    | .    | .    | 0.032 |
| 38   | .    | .    | .    | 0.032 |
| .    | .    | 14   | 27   | 0.031 |
| 39   | .    | .    | .    | 0.030 |
| 40   | .    | 15   | 28   | 0.029 |
| 41   | .    | 15   | 28   | 0.029 |
| 42   | .    | .    | 29   | 0.027 |
| 43   | .    | 16   | 30   | 0.026 |
| 44   | .    | 16   | 30   | 0.026 |
| 45   | .    | 17   | 31   | 0.025 |
| 46   | .    | .    | 32   | 0.024 |
| 46   | .    | .    | 33   | 0.024 |
| 47   | .    | 18   | 34   | 0.023 |
| 48   | .    | 19   | 35   | 0.022 |
| 48   | .    | 19   | 36   | 0.022 |
| 48   | .    | 19   | 37   | 0.022 |
| 49   | .    | 20   | 38   | 0.021 |

Table 3.8-1 (continued). Attenuation and rain rate percent-of-time data for July, August, September, October, and December, 1977.

| RAIN | ACTS | AV19 | AC28 | PER   |
|------|------|------|------|-------|
| 49   | .    | 20   | 39   | 0.021 |
| 49   | .    | 20   | 40   | 0.021 |
| 50   | .    | .    | 41   | 0.020 |
| 51   | .    | 21   | 42   | 0.019 |
| 52   | .    | 21   | 42   | 0.019 |
| 53   | .    | .    | 43   | 0.018 |
| 53   | .    | .    | 44   | 0.018 |
| 54   | .    | 22   | 45   | 0.017 |
| 55   | .    | 22   | 45   | 0.017 |
| 56   | .    | .    | .    | 0.016 |
| 57   | .    | .    | .    | 0.016 |
| 58   | .    | 23   | 47   | 0.015 |
| 58   | .    | 24   | 47   | 0.015 |
| 59   | .    | .    | 48   | 0.014 |
| 59   | .    | .    | 49   | 0.014 |
| .    | .    | 25   | .    | 0.013 |
| .    | .    | 26   | .    | 0.013 |
| 60   | .    | 27   | .    | 0.012 |
| 60   | .    | 28   | .    | 0.012 |
| 61   | .    | 30   | .    | 0.011 |
| 62   | .    | 30   | .    | 0.011 |
| 63   | .    | 30   | .    | 0.011 |
| 64   | .    | 30   | .    | 0.011 |
| 65   | .    | 31   | .    | 0.010 |
| 65   | .    | 32   | .    | 0.010 |
| 65   | .    | 33   | .    | 0.010 |
| 65   | .    | 34   | .    | 0.010 |
| 69   | 33   | 35   | .    | 0.009 |
| 70   | 33   | 36   | .    | 0.009 |
| 71   | 33   | 37   | .    | 0.009 |
| 72   | .    | 38   | .    | 0.008 |
| 74   | .    | 39   | .    | 0.008 |
| 75   | .    | 40   | 50   | 0.007 |
| 75   | .    | 40   | 51   | 0.007 |
| 76   | 43   | 41   | 54   | 0.006 |
| 77   | 43   | 41   | 56   | 0.006 |
| 79   | 43   | 41   | 58   | 0.006 |
| 80   | .    | .    | 57   | 0.005 |
| 81   | .    | .    | 60   | 0.005 |
| 81   | .    | .    | 61   | 0.005 |
| 82   | .    | .    | 63   | 0.004 |
| 86   | .    | .    | 64   | 0.004 |
| 88   | .    | .    | 66   | 0.004 |
| 88   | .    | .    | 67   | 0.004 |
| 91   | .    | .    | 68   | 0.003 |
| 92   | .    | .    | 70   | 0.003 |
| 93   | .    | .    | 72   | 0.003 |
| 93   | .    | .    | 73   | 0.003 |
| 97   | .    | .    | 74   | 0.002 |
| 100  | .    | .    | 77   | 0.002 |
| 102  | .    | .    | 79   | 0.002 |
| 103  | .    | .    | 79   | 0.002 |
| 106  | .    | .    | 79   | 0.002 |
| 112  | .    | .    | 80   | 0.001 |

Table 3.8-1 (continued). Attenuation and rain rate percent-of-time data for July, August, September, October, and December, 1977.

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| RAIN | ACTS | AV19 | AC28 | PER   |
|------|------|------|------|-------|
| 113  | 50   | 50   | 80   | 0.001 |
| 121  | 50   | 50   | 83   | 0.000 |
| 198  | 50   | 57   | 114  | 0.000 |
| 201  | 50   | 57   | 114  | 0.000 |

Table 3.8-1 (continued). Attenuation and rain rate  
percent-of-time data for  
July, August, September,  
October, and December, 1977.

Table 3.8-2. Regression equations for the period July, August, September, October, and December, 1977.

| Relationship                                             | 11.7 GHz |                |                |  | 19.04 GHz                    |                |                |  | 28.56 GHz                    |                |                |  |
|----------------------------------------------------------|----------|----------------|----------------|--|------------------------------|----------------|----------------|--|------------------------------|----------------|----------------|--|
|                                                          | Equation | N <sub>s</sub> | R <sup>2</sup> |  | Equation                     | N <sub>s</sub> | R <sup>2</sup> |  | Equation                     | N <sub>s</sub> | R <sup>2</sup> |  |
| I on log <sub>10</sub> (A) for 3 < A < 30                |          |                |                |  |                              |                |                |  |                              |                |                |  |
| A on R at equal probability levels.                      | *        |                |                |  | A = .59 R <sup>.93</sup>     | 47             | .91            |  | A = 2.09 R <sup>.76</sup>    | 59             | .92            |  |
| Attenuation scaling. A (11) at equal probability levels. |          |                |                |  | *                            |                |                |  | *                            |                |                |  |
| Attenuation scaling. A (19) at equal probability levels. | *        |                |                |  |                              |                |                |  | A(19) = .27*<br>A(28) = 1.19 | 29             | .89            |  |
| Attenuation scaling. A (28) at equal probability levels. | *        |                |                |  | A(28) = 4.02*<br>A(19) = .75 | 29             | .89            |  |                              |                |                |  |

\* Invalidated by spacecraft motion during December, 1977.